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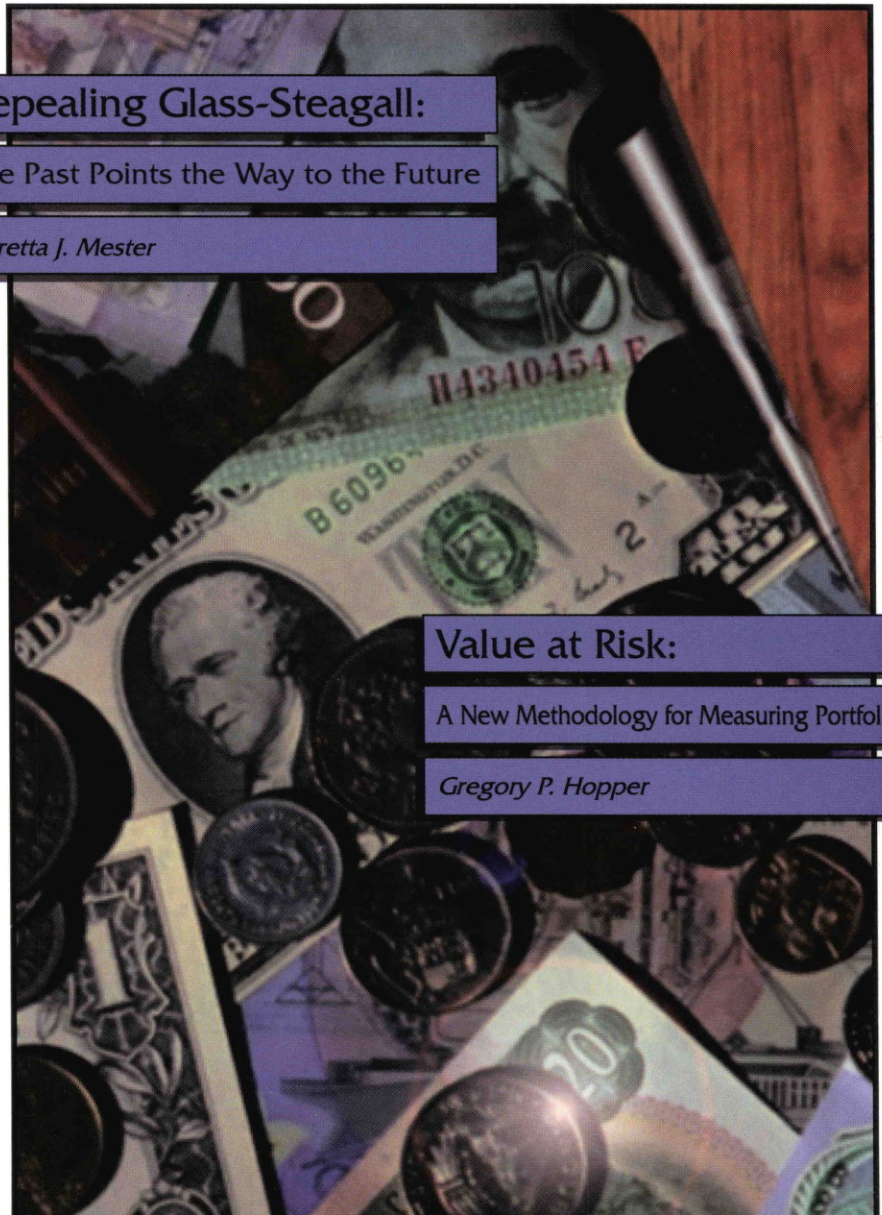

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The Past Points the Way to the Future

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Value at Risk:

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Repealing Glass-Steagall: The Past Points the Way to the Future

*Loretta J. Mester**

In many countries, commercial banks are allowed to perform investment banking activities such as helping their corporate customers bring new debt and equity issues to market. Yet in the United States, since the Glass-Steagall Act was passed in 1933, most U.S. commercial banks are not permitted to engage in such underwriting. Congress is debating whether to repeal this act. The legislation has undergone several revisions: some versions advocated allowing commercial banks to affiliate with investment banks in the same holding company, and some advocated allowing commercial banks to directly underwrite securities. While passage has seemed probable at many points, the measure has stalled. But this has more to do with provisions concerning commercial banks' right to sell insurance than with the proposed repeal of the separation between commercial and investment banking.

Should Glass-Steagall be repealed? Bankers argue that the economic environment in which they operate has become much more competitive and that they will fall behind unless they are permitted to expand their set of profitable activities, including investment banking. And

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it might be more efficient for commercial banks to engage in underwriting, since banks already have much information about their corporate customers. If so, society would gain from having commercial banks engage in investment banking, since they could do it efficiently. On the other hand, as was argued at the time Glass-Steagall was passed, there are potential conflicts of interest between commercial banking and underwriting. Whether these conflicts of interest are present and whether they impose costs that outweigh the potential benefits of commingling investment and commercial banking activities is an empirical question.

Several studies have sought evidence on this question by looking at the experience of banks before 1933, when they were allowed to underwrite securities with few restrictions; one study looks at more recent experience. The results suggest that conflicts of interest were not a major problem and still aren't—they support repeal of the Glass-Steagall Act of 1933. The studies present mixed results on whether it is better to have a commercial bank directly underwrite securities or to house the commercial banking activities and investment banking activities in separate subsidiaries of a holding company.

THE ORIGINS OF GLASS-STEAGALL

One of the main activities of an investment bank is *underwriting*. When a firm wishes to issue new debt or equity, it goes to an investment bank, which prepares the issue. In underwriting, the investment bank usually guarantees to the firm that it will sell the issue at a specified price, which the bank determines after a credit evaluation of the firm and an assessment of market conditions. If the issue cannot be sold at the guaranteed price, the underwriter incurs the loss. This loss could occur because an unforeseen event causes the price of the issue to change during the period in which the underwriter is trying to distribute the issue or because buyers have a different view of the firm's value than the underwriter did. Thus, to limit its own risk exposure, a good underwriter will need to know a lot about the firm and the firm's market and be able to certify to the market that its assessment of the firm's value is correct.

Prior to passage of the 1933 Glass-Steagall Act, state banks that were not members of the Federal Reserve System were permitted to underwrite securities and bonds. The McFadden Act of 1927 allowed national banks to underwrite bonds, and they were later allowed to underwrite certain equity issues. But even before 1927, national banks engaged in securities activities by organizing state bank affiliates.[1] So by the early 1920s, many commercial banks were heavily involved in the underwriting and distribution of securities.[2] The number peaked in 1928 when 591 commercial banks were engaged in securities activities either directly or through securities affiliates; of these, 235 were national banks and 356 were state-chartered.[3]

The background against which the Glass-Steagall Act was passed was one of tumult in financial markets. The economy was in depression; there was a record number of bank failures. To the average person, it appeared the stock market crash had caused the Great Depression, and banks had had a large role in the stock markets. This perception, coupled with widespread bank failures, led Congress to begin a series of investigations into market abuses and ways to reform the banking system, includ-

[1]Two companies are affiliates of one another if they have a common owner. One company is a subsidiary of another company if it is owned by that other company.

[2]For a review of the early history of bank securities activities, see Benston (1990 and 1996) and Kroszner (1996).

[3]See Kroszner and Rajan (1994). Of course, in percentage terms, the number of banks engaged in securities activities was quite small—around 2.5 percent—since there were nearly 25,000 commercial banks in 1928 (see Board of Governors of the Federal Reserve System, November 1943).

ing the famous Pecora hearings of the U.S. Senate in 1933-34.[4]

Congress was concerned about certain questionable activities by banks and their securities affiliates. These activities included loans made by banks to their securities affiliates, loans extended by banks to others who wanted to buy securities from the banks' securities affiliates, banks' buying securities underwritten by their affiliate for their own or their customers' accounts, and securities affiliates buying the stock of firms that were customers of the bank. Rather than restrict these specific activities, Congress chose to separate commercial and investment banking altogether by passing the Glass-Steagall Act, which comprises four sections (16, 20, 21, and 32) of the National Bank Act of 1933.

Sections 16 and 21 prevent any bank that accepts deposits from *directly* engaging in most securities activities except for those involving municipal general obligation bonds, U.S. government bonds, private placements of commercial paper, and real estate bonds; these four are called "eligible securities." Sections 20 and 32 address *indirect* securities activities through bank subsidiaries or affiliates and apply to banks that are members of the Federal Reserve System (which includes all national banks and state-chartered banks that choose to become members). Section 20 prohibits these banks from affiliating with any organization "engaged principally" in underwriting securities, and Section 32 prohibits director, officer, or employee interlocks between these banks and firms "primarily engaged" in securities activities.

THE EROSION OF GLASS-STEAGALL

Since Glass-Steagall was passed, commercial banks have gradually added some investment banking activities to their portfolio of permissible products. Today, commercial banks can perform agency functions for individual clients, that is, act as the client's agent in the market, including buying and selling stocks, safekeeping securities, and switching funds between bank accounts and stock accounts. They can operate discount brokerages, through which the public can buy stocks, and act as private placement agents (an issue marketed only to a few sophisticated investors is a private placement and legally is not a security). They can advise clients on mergers. They can underwrite and deal in municipal general obligation bonds, U.S. government bonds, Eurobonds (i.e., bonds issued outside the U.S.), municipal revenue bonds, and asset-backed securities. Some banks can underwrite and deal in corporate debt and equities, at least to a certain extent.

They've been able to do this without violating Glass-Steagall by arguing that the different language in Sections 20, 21, and 32 of the act—namely "engaged principally" in Section 20, "engaged" in Section 21, and "primarily engaged" in Section 32—indicates Congress established different standards for determining compliance with each of the provisions. Since the three terms weren't defined in the act, it has been up to the courts and regulators to determine the meaning and see that banks comply. In a series of orders beginning in December 1986, the Federal Reserve stated that subsidiaries of bank holding companies set up to underwrite U.S. government securities (which were always "eligible" securities under Glass-Steagall) may underwrite certain "bank ineligible" securities (the securities not included in the original four that Glass-Steagall allowed banks to underwrite) without violating Section 20 as long as the revenues obtained from underwriting these ineligible securities were within certain limits. (See the Appendix: *A Time Line of Permissible Securities Activities.*)

[4]The Stock Exchange Practices hearings of the Senate Committee on Banking and Currency were chaired by Senator Ferdinand Pecora. See Benston (1990) for discussion.

ARGUMENTS FOR AND AGAINST REPEAL OF GLASS-STEAGALL

Despite the fact that banks have been permitted to engage to some extent in the underwriting of corporate debt and equity and other ineligible securities, these activities are still highly regulated. Banks wishing to underwrite ineligible securities must seek approval from the Fed to set up so-called "Section 20" affiliates, and the revenue limits placed on such underwriting have begun to become binding on some banks.[5] As of March 31, 1996, in the U.S. there were 38 Section 20 subsidiaries of commercial bank holding companies authorized to engage in limited underwriting of and dealing in ineligible securities, including municipal revenue bonds, 1-4 family conventional mortgage-backed securities, commercial paper, and asset-backed securities (Table 1).[6] Twenty-one of these subsidiaries were authorized to underwrite both corporate debt and equity securities, and an additional three were authorized to underwrite corporate debt but not equities. Most of these organizations are located in the New York Federal Reserve District, where they can directly compete with large investment banks.

Arguments for Repeal. The erosion of Glass-Steagall suggests that commercial banks have had strong incentives to get into securities activities and that regulators have had incentives to allow the banks to do so. One reason banks want to perform these activities is that they are profitable. As financial markets have become deregulated, banks have faced increased competition for their core businesses of deposit-taking and loan-making. In addition, technological advances have allowed firms increased access to funding from nonbank sources. Thus, finding new pathways to profits has become increasingly important for commercial banks, and it appears that underwriting securities is one such avenue. For example, in 1993, the average return on equity for large investment banks was over 23 percent; for New York Stock Exchange broker/dealer firms it was about 16.25 percent; and for commercial banks it was about 15.25 percent.[7] For the period 1990 to 1993, the return on equity averaged about 17.5 percent for investment banks and about 11 percent for commercial banks.

In addition, commercial banks that could also offer unlimited underwriting services would be able to retain some of their most creditworthy customers. These customers usually find it cheaper to issue commercial paper than to take out bank loans, so they have been turning to the markets to raise funds. Because of the legal limits on the amount of commercial paper commercial banks are permitted to underwrite, they have lost some of their better customers. This loss could lead to a contraction in the banking industry, which could impose costs on smaller, less creditworthy firms that cannot access the markets directly but depend on bank loans for financing.

One can also make the argument that allowing commercial and investment banking activities within the same institution could make the industry safer by allowing more diversification.[8] In addition, there could be natural synergies between commercial and investment

[5]Hays and Wilke (1996) and Rehm (1994) discuss banks hitting the revenue limit. The Federal Reserve recently fined Swiss Bank Corporation $3.5 million for exceeding the revenue limit.

[6]Some are foreign owned; one of the subs has been dormant since June 1995; one holding company has two Section 20 subs.

[7]Data from the Board of Governors of the Federal Reserve System, and from the *FDIC Quarterly Banking Profile*, FDIC, Third Quarter 1995.

[8]But there is mixed evidence on whether mixing commercial banking with other nonbank activities leads to lower insolvency risk for the institution. See Mester (1992a) for a brief literature review of the empirical evidence.

TABLE 1
Section 20 Subsidiaries

Banking organizations authorized to underwrite and deal in certain municipal revenue bonds, mortgage-related securities, commercial paper, and asset-backed securities as of March 31, 1996, listed by Federal Reserve District.

	Date of Initial Board Order Authorization
Boston District	
Fleet Financial Group	10/88
New York District	
Banco Santander, S.A.[a]	3/95
The Bank of Nova Scotia[a]	4/90
Bankers Trust N.Y. Corp.[a]	4/87
Barclays Bank PLC[b]	1/90
Canadian Imperial Bank of Commerce[a]	1/90
Chase Manhattan Corp.[a]	5/87
Citicorp[a]	4/87
Deutsche Bank AG[a]	12/92
HSBC Holdings PLC[a]	2/96
The Long-Term Credit Bank of Japan, Ltd.	5/90
J.P. Morgan & Co.[a]	4/87
The Royal Bank of Canada[a]	1/90
Saban/Republic New York Corp.[a]	1/94
Swiss Bank Corp.[a]	12/94
The Toronto-Dominion Bank[a]	5/90
Philadelphia District	
Dauphin Deposit Corp.[a]	6/91
Cleveland District	
Bank One Corp.	7/90
Huntington Bancshares, Inc.	12/92
KeyCorp	2/96
Mellon Bank Corp.	4/95
Cleveland District (continued)	
National City Corp.[a]	2/94
PNC Bank Corp.	7/87
Richmond District	
First Union Corp.[a]	8/89
NationsBank Corp.[a]	5/89
Atlanta District	
Barnett Banks, Inc.[c]	1/89
SouthTrust Corp.	7/89
SunTrust Banks, Inc.	8/94
Synovus Financial Corp.	9/91
Chicago District	
ABN AMRO Bank N.V.[a,d]	6/90
The Bank of Montreal[a]	5/88
First of America Bank Corp.[b]	10/94
First Chicago NBD Corp.[b]	8/88
Minneapolis District	
Norwest Corp.	12/89
San Francisco District	
BankAmerica Corp.[a]	3/92
Dai-Ichi Kangyo Bank Ltd.	1/91
The Sanwa Bank, Ltd.	5/90

[a]Also has corporate debt and equity securities powers.
[b]Also has corporate debt securities powers.
[c]As of June 30, 1995, the Section 20 subsidiary was dormant.
[d]Has two Section 20 subsidiaries.

Source: Various issues of the *Federal Reserve Bulletin*.

banking. For example, credit evaluation is important in both. Loan syndication, which is permitted for commercial banks, is very similar to underwriting. And banks are already experienced at underwriting eligible securities. There may be scope economies from reusing information from the credit evaluation of a borrower who subsequently wants to issue debt.[9] Commercial banks obtain valuable (inside) information on their customers from monitoring their loans: they see the firms' payment history and cash flows. So when the issuing firm is a customer of a commercial bank, the information this bank would have if it were to underwrite the issue is likely to be more accurate than the information an investment bank underwriter would have. Thus, it might be more efficient having commercial banks engage in underwriting than having specialized investment banks do it—if so, society would gain.

Arguments Against Repeal. These potential benefits have to be weighed against the potential costs stemming from possible conflicts of interest between commercial banking and underwriting.[10] (If there are no costs, one could argue for repeal even if potential benefits are meager.) Some of these conflicts were raised during the Pecora hearings. A commercial bank might promote the securities it underwrites and misrepresent the quality of these securities to its depositors instead of offering them disinterested investment advice. Or the bank might induce a troubled loan customer to issue new securities to repay the loan. This imposes costs. If investors in these securities are naive, they are penalized: they purchase poor quality securities thinking they are good. If, however, investors are not naive, they know such a conflict of interest might exist and will, therefore, adjust down the price they are willing to pay for such securities. In this case, the issuing firms that use commercial bank underwriters bear the cost: they receive less funding than they would like, so there is underinvestment.[11] The economy is worse off, since some good investments go unfunded. A cost is also imposed on commercial banks that want to develop reputations for good underwritings.

These potential costs from a possible conflict of interest have to be weighed against the potential benefits of allowing commercial banks to underwrite. There is a trade-off: a commercial bank may obtain needed information more efficiently than an investment bank, but it may misrepresent this information to the market. An investment bank doesn't have ties to the issuer, so it has less incentive to misrepresent the information, but its information may not be as accurate. Whether the information cost savings of a commercial bank underwriter outweigh the costs imposed by the potential conflict of interest is an empirical question.

EMPIRICAL EVIDENCE ON CONFLICTS OF INTEREST

If conflicts of interest presented problems, such problems should have manifested them-

[9]But, again, there is some empirical evidence that suggests this may not be the case. See Mester (1992b).

[10]Saunders (1985), Saunders and Walter (1994), and Walter (1985) also discuss conflict-of-interest arguments against repeal of Glass-Steagall.

[11]While the underwriter bears the cost if it guarantees a high price to the issuer and can obtain only a low price when selling the securities to investors, a smart commercial bank underwriter would take into account the smart investors' downward price adjustment and not guarantee a high price to the issuer. Hence, it's the issuer that bears this cost, and society, since some good investment projects go unfunded.

To the extent that a firm could switch to an investment bank underwriter, this underinvestment problem would go away. But switching might be difficult because the market might not be able to determine whether a firm was switching to avoid the underpricing problem or because its commercial bank refused to underwrite the firm's securities because they were not of high enough quality (see Rajan, 1996). The underinvestment problem could also be avoided if firms used only investment banks to underwrite their securities.

selves in the period before Glass-Steagall was enacted. Yet empirical studies that examine the 1920s and early 1930s suggest that conflicts were not generally a problem, and a study of the modern securities activities of commercial banks suggests they still aren't.[12] (Note, however, that finding no conflict of interest is not the same thing as finding benefits to allowing commercial banks into underwriting.)

Actual Performance. If banks systematically underwrote poorer quality security issues and passed them off to their depositors, the issues underwritten by commercial banks would probably have performed worse than similar issues underwritten by investment banks over the same period—that is, the measures of actual performance would differ according to the underwriter. Also, if the public had been taken advantage of in this way, it probably would have been easier to do with issues of low-quality and lesser-known firms, about which little public information was circulating. But three interesting studies all found evidence that securities underwritten by commercial banks actually outperformed those underwritten by investment banks in the pre-Glass-Steagall period.

Manju Puri (1994) studied the default performance and mortality rates (default rates adjusted for the ages of the issues) of a sample of securities issued over the period January 1927 to September 1929, when national as well as state banks were authorized to underwrite bonds (Table 2). In comparing the default performance of the issues she not only distinguishes between issues underwritten by commercial banks and investment banks (which she calls nonbanks), but also issues underwritten by National City Company and Chase Securities Corporation. These so-called rogue banks were accused of abuses and investigated by Congress in hearings surrounding Glass-Steagall. She also considers the type of security underwritten and whether the issue was investment or noninvestment grade.

Puri generally finds that the mortality rates for issues underwritten by commercial banks are significantly lower (in a statistical sense) than those underwritten by investment banks. For example, she finds that seven years after issue, about 25 percent of the industrial bonds underwritten by commercial banks had defaulted, while almost 40 percent of those underwritten by investment banks had defaulted. She finds statistically significant differences for these bonds three years and five years after issue as well, and significant differences even when the bonds were divided into investment and noninvestment grade issues. For preferred stock, the results are a bit weaker, perhaps because the sample size is smaller. Puri did not find a significant difference in mortality for foreign bond issues taken as a group, but she did find one for the noninvestment grade subgroup. Perhaps not surprisingly, she finds that issues underwritten by the rogue banks generally defaulted more than issues underwritten by the other banks. She didn't report a statistical test, but her estimates suggest that, at least for the older issues, rogue bank issues defaulted more than investment bank issues.

James Ang and Terry Richardson (1994) studied a sample of 669 domestic and foreign corporate and foreign government bonds underwritten from 1926-34 and obtained results similar to those of Puri. They studied the default experience of these issues from the time of issue until 1939 and found that commercial bank underwritings significantly outperformed those of investment banks: about 40 percent

[12]Bank of United States is often cited as an example of a bank that failed because of its affiliates' abusive practices. But as Benston (1996) notes, only one of these affiliates dealt in securities, and it was engaged in purchasing the bank's stock, not in underwriting other firms' securities. The rest were involved in real estate. Benston cites rapid expansion and misappropriation of funds by the bank's owners as the chief reasons for the bank's failure.

TABLE 2
Empirical Studies

Study	Time Period	Sample	Selected Results
Puri (1994)	January 1927 to September 1929	Samples ranged in size from 365 to 382 issues. Default experience over the seven years after issue was available for 181 industrial bonds, 81 preferred stock issues, and 103 government bonds. Default experience over the year after issue was available for 182 industrial bonds, 95 preferred stock issues, and 105 foreign government bonds. In the larger sample, 134 issues were underwritten by commercial banks and 248 were underwritten by investment banks.	Issues underwritten by commercial banks defaulted less often than issues underwritten by investment banks.
Puri (1996)	Same as above.	Same as above.	Issues underwritten by commercial banks had lower initial yields than issues underwritten by investment banks. Compared to issues underwritten by investment banks, issues underwritten by commercial bank affiliates had similar initial yields while issues underwritten directly by commercial banks had lower initial yields.
Ang and Richardson (1994)	1926-34	669 domestic and foreign corporate bonds and foreign government bonds. 121 were underwritten by commercial banks, 451 were underwritten by investment banks, and 97 were underwritten by Kuhn, Loeb and Co. or J.P. Morgan.	Issues underwritten by commercial banks defaulted less often and had lower initial yields than issues underwritten by investment banks.
Kroszner and Rajan (1994)	First quarters 1921-29	462 industrial bonds. 133 were underwritten by commercial banks and 329 were underwritten by investment banks. Used to form 121 matched pairs.	Issues underwritten by commercial banks defaulted less often and had lower initial yields than issues underwritten by investment banks. Commercial banks were more likely to underwrite issues of larger, older, and less leveraged firms, firms listed on the stock exchange, and senior securities.
Kroszner and Rajan (1995)	1925-29	906 issues of common and preferred stock and corporate and government bonds underwritten by commercial banks. 580 were underwritten by commercial bank affiliates and 326 were underwritten directly by commercial banks.	Initial yields on issues underwritten by commercial bank affiliates were lower than initial yields on issues underwritten directly by commercial banks.
Gande, Puri, Saunders, and Walter (1995)	January 1, 1993 to March 31, 1995	670 fixed-rate, nonconvertible debt issues of nonfinancial corporations. 80 were underwritten by Section 20 affiliates of commercial banks and 590 were underwritten by investment banks.	Initial yields on issues underwritten by Section 20 subsidiaries of commercial banks and by investment banks were generally the same, but initial yields on issues with low credit ratings whose proceeds were not being used to repay issuer's bank loans were lower when underwritten by Section 20 subsidiaries.

defaults compared with more than 48 percent defaults for the investment bank issues; commercial bank issues outperformed investment bank issues for each type of security examined. They also found that the issues underwritten by Kuhn, Loeb and Co. and J.P. Morgan, institutions that were difficult to classify as either commercial or investment banks, outperformed both commercial and investment bank issues, with a default rate of only 30 percent. But even including these two institutions among investment banks does not change the result that commercial bank underwritings defaulted less often than investment bank underwritings. In their study, National City and Chase did worse than other commercial banks, but they seem to have been on a par with investment banks.

Randall Kroszner and Raghuram Rajan (1994) conducted a matched-sample test of 121 pairs of industrial bonds underwritten during the first quarters of 1921-29. The bonds in each pair were matched in terms of their initial rating, time when issued, maturity, size, and type of conversion provisions, but one bond in the pair was underwritten by a commercial bank while the other was underwritten by an investment bank.[13] Again, their results agree with those of the other studies: they find that at the end of every year after 1924, fewer cumulative defaults occurred among the issues underwritten by commercial banks than among those underwritten by investment banks. By 1940, 32 percent of investment-bank underwritings had defaulted compared with 23 percent of commercial bank underwritings. Thus, these three studies of the performance of issues found no evidence that commercial banks were foisting off low-quality securities on investors.

Expected Performance. While the actual performance of these issues is important, so is the expected performance. Only if, on average, default of the issues was *greater than expected* can one conclude that investors were being duped by the underwriter. Evidence on this can be garnered by looking at the pricing of the issues. Studies by Ang and Richardson (1994) and Puri (1996) found that securities underwritten by commercial banks were priced higher (that is, their yields were lower) at the time of issue than securities underwritten by investment banks, meaning that investors did not require that a high risk premium be built into the yield to induce them to buy commercial bank issues.

For example, Ang and Richardson found that over 1926-30 the initial yield on issues underwritten by commercial banks averaged about 26 basis points lower than the yield on issues underwritten by investment banks.[14] Apparently investors did not perceive that issues underwritten by commercial banks were necessarily more risky than those underwritten by investment banks. The study also found that the actual yield performance (that is, the return over the life of the issue) of the issues underwritten by commercial banks was better than that of investment bank issues, which is consistent with the default rate results discussed above.

Moreover, Ang and Richardson also performed a statistical test to shed some light on whether investors were *rationally* assessing the value of the issues. If they were, the yield at the time of issue should be a good predictor of the realized yield of the issue. Ang and

[13]Their definition of a commercial-bank-underwritten issue was broader than Puri's. An issue was classified as a commercial bank underwriting if a commercial bank was a member of the group of institutions, that is, the syndicate—either as a lead or subordinate member—that underwrote the issue. Puri classified an issue as a commercial bank underwriting only if a commercial bank was the sole underwriter or the lead underwriter, arguing that subordinate members of a syndicate could exert only a limited amount of influence on other members.

[14]A basis point is 1/100th of a percent.

Richardson found no evidence that the market mispriced issues underwritten by commercial banks and no evidence that the predictive power of the issue price for realized yield was different for commercial-bank-underwritten issues than for investment-bank-underwritten issues. Hence, they found no evidence that investors were behaving irrationally when they accepted lower yields for the commercial bank issues.

Examining the same sample of issues as in her previous study, Puri (1996) also found that investors were willing to pay higher prices (that is, accept lower yields) for securities underwritten by commercial banks than investment banks, after controlling for other factors that would have affected prices.[15] This result held for both industrial bonds, where the yield at the time of issue on commercial bank underwritings averaged between 8 and 13 basis points lower than that on similar investment bank underwritings (depending on the statistical methodology used), and for preferred stock issues, where the difference was between 22 and 37 basis points.[16]

One interpretation of this result is that investors assessed that the commercial bank's potential information advantage over the investment bank outweighed any potential conflict-of-interest problem in the commercial bank. Hence, they were willing to pay higher prices for issues underwritten by commercial banks. If so, issuers did not bear the costs of potential conflicts of interest. Consistent with this interpretation is Puri's finding that the difference in yields for commercial and investment bank issues was greater for new issues (that is, issues different from the type, either bonds or preferred stock, that the firm had outstanding in the market) than for seasoned issues (that is, issues that were similar in type to ones the firm had outstanding in the market). Typically there is less public information available on new issues, so any private information a commercial bank has should be more valuable for new issues than for seasoned issues. So if the market believes the commercial bank has an information advantage over the investment bank in underwriting, and this influences the prices it is willing to pay for securities, one would expect to see a larger price difference between commercial bank underwritings and investment bank underwritings for new issues than for seasoned issues, which is what Puri found. She also found no yield differential in foreign bond underwritings. Since prior lending relationships were not important in gaining customers in this market, there was little reason to believe a commercial bank's information was superior to that of an investment bank underwriter.

Types of Issues. The default and price results are based on a comparison of issues underwritten by commercial and investment banks that are similar in other respects so that any differences found can be attributed to underwriter type. For example, the studies compare securities of similar types, with the same maturities, size, and so on. But the studies also found that the general types of securities underwritten by commercial and investment banks differed. Puri (1996) found that commercial banks were more likely to underwrite corporate bonds than preferred stock, and of the

[15]These factors included whether the issue was investment grade, the size of the issue, the size of the underwriting syndicate, whether the issue was traded on an exchange, the firm's age, and whether the firm had issues of the same type (either bonds or preferred stock) outstanding in the market. Puri used this last factor to define whether the issue was a new or seasoned issue, since it was not possible from the available data to determine whether an issue was the firm's first ever issue of a bond or preferred stock.

[16]Given that commercial bank underwriters appear to have been able to generate higher prices for their issuers, there is a question as to why any issuer would have chosen an investment bank as underwriter. Puri (1996) suggests that one reason might be that investment banks charged lower fees (although she has no data on fees to confirm this conjecture).

corporate bond issues, they were more likely to underwrite seasoned issues, those of older firms, those with less underlying collateral securing the issue, and those with a larger number of underwriters in the syndicate. Kroszner and Rajan (1994) found that commercial banks were more likely to underwrite larger and older firms, firms listed on the stock exchange, less leveraged firms, and senior securities such as debt rather than stock. These characteristics are generally consistent with higher quality issues. Moreover, they found that these differences were more pronounced for smaller banks than for larger ones.

Kroszner and Rajan argue that one explanation for their findings is that commercial banks were deliberately choosing to underwrite high-quality issues, which involve less insider information, and so have lower potential conflicts of interest. That is, commercial banks wanted to indicate to the market that they were credible underwriters, so they focused on the types of issues that minimized the risk of conflicts of interest. Since small banks, as relative unknowns, likely need to do more to build their reputations, Kroszner and Rajan's result showing that small banks focused even more on high-quality issues than large banks did is consistent with this explanation.

However, other plausible explanations have little to do with conflicts of interest. For example, it could be that commercial banks focused on debt securities rather than equities because they had more expertise with these types of securities. Recall that this was the type of security they were first authorized to underwrite, and debt securities are more like commercial bank loans.[17]

Recent Experience. I know of only one study of the underwriting experience of commercial banks since the Federal Reserve permitted limited underwriting of ineligible securities. It is still too early to determine the default experience of recent issues, but Amar Gande, Manju Puri, Anthony Saunders, and Ingo Walter (1995) were able to examine the pricing of issues underwritten by the top 20 underwriters (in terms of the dollar volume of their underwritings) of fixed-rate, nonconvertible debt issues of nonfinancial corporations over the period January 1, 1993, to March 31, 1995. This sample included four underwriters that are Section 20 subsidiaries of commercial bank holding companies: J.P. Morgan, Citicorp, Bankers Trust, and Chase.

In addition to isolating a commercial bank's corporate debt and equity underwriting activities in a separate affiliate of the commercial bank within the holding company, regulators impose firewalls that limit the financial and information flows between the securities and commercial bank subsidiaries. Firewalls are intended to stop the conflict-of-interest problem, but at the same time, they restrict the ability of commercial banks to take advantage of any informational edge they may have in underwriting as a result of their lending activity.

Gande, Puri, Saunders, and Walter studied the effectiveness of these firewalls by comparing the pricing of similar issues underwritten by Section 20 subsidiaries and investment banks, while controlling for the lending relationship between the commercial bank underwriter and the issuer. That is, the study goes a step further at getting at the conflict-of-interest problem by controlling for the volume of loans an issuer has gotten from the commercial bank affiliate of its Section 20 underwriter. (Recall that the potential conflict-of-interest problem should be worse when a commercial bank underwriter has also extended loans to the issuer.) If firewalls have successfully prevented conflicts of interest *and* have precluded the commercial bank from taking advantage of any informational edge it might have over the investment bank underwriter, one would expect to see no difference in the initial yields of similar

[17]See Puri (1996) for further discussion.

Section 20 and investment bank underwritings. One would also expect to see no yield difference if there weren't any conflicts of interest or informational advantages in the first place, or if the conflicts of interest just offset the informational advantages, regardless of the effectiveness of firewalls. On the other hand, if the market assesses that the informational advantages of the commercial bank underwriter outweigh any conflicts of interest and that the firewalls are not fully effective at isolating the underwriting function from the commercial banking function, yields on issues underwritten by Section 20 subsidiaries should be lower than those on investment bank underwritings.

Similarly, if the market assesses that the potential conflict-of-interest problem outweighs any potential informational advantage commercial banks have in underwriting and that the firewalls are not fully successful in controlling conflicts of interest, the market should require a higher risk premium to take on commercial bank underwritings. Thus, initial yields on Section 20 subsidiary underwritings should be greater than initial yields on investment bank underwritings.

The authors found no statistically significant difference, on average, in the yields of issues underwritten by Section 20 subsidiaries and similar issues underwritten by investment banks.[18] Thus, it appears that, on average, either firewalls have been effective at isolating the underwriting and commercial bank functions or that any informational advantages just offset any conflicts of interest. However, they also found that when a Section 20 subsidiary underwrites issues whose proceeds are not intended to repay the issuer's bank loans and the issue has a low credit rating, the yield at the time of issue is significantly lower than if an investment bank underwrites the issue. These issues are likely to present the fewest conflict-of-interest problems, since the proceeds of the issue are not being used to repay a loan and thereby shift the risk out of the bank underwriter's loan portfolio on to those who purchase the underwritten issues. And any informational advantage that a commercial bank underwriter has is likely to be most valuable with lower rated issues. The fact that the market accepts a lower yield suggests that *for this type of security issue* the market believes that the commercial bank's information advantage outweighs the cost from any conflict of interest and that firewalls are not fully isolating the underwriting function from the commercial banking function.[19] It is too early to tell whether these beliefs are rational, since it depends on the actual default experience of the issues.

EMPIRICAL EVIDENCE ON ORGANIZATIONAL STRUCTURE

While the empirical studies have been consistent in suggesting that conflicts of interest have not been a major problem that should preclude commercial banks from participating in securities activities, they provide mixed evidence on the way these activities should be organized. The version of the repeal legislation that Congress has been considering in its current session would allow commercial banks into securities activities through a holding company structure, the same structure that has been used since the Federal Reserve permitted limited securities activities in 1987. That is, rather than the commercial bank's engaging in the securities activities directly, the securities and commercial banking activities would be in separate subsidiaries of a financial service holding company. The separate affiliates would be

[18]While they found that, on average, yields on Section 20 underwritings were lower than yields on investment bank underwritings, the difference was not statistically significant.

[19]The authors also find no evidence of the conflict-of-interest problem in those issues where one might expect the problem to be severe, namely, in issues whose proceeds are being used to repay bank loans.

further protected by a system of firewalls.

This organizational structure with firewalls provides a benefit in lowering the potential for conflicts of interest and so lowers the costs commercial banks and issuers must incur to assure investors their issues are high quality. But it also imposes a cost by making the information-sharing between the lending and underwriting functions more difficult. The study by Gande, Puri, Saunders, and Walter indicates that, recently, firewalls haven't always been effective in totally separating the commercial bank and securities affiliates, but it also indicates that conflicts of interest haven't been a problem.

Two other studies that examined issues directly underwritten by commercial banks and those underwritten by an affiliate of a commercial bank in the pre-Glass-Steagall period came up with conflicting conclusions as to which organizational structure is preferable. Kroszner and Rajan (1995) found that firewalls appear to have been valuable in helping commercial bank underwriters convince the market they were not trying to foist off poor-quality issues. They studied 906 issues underwritten by commercial banks between 1925 and 1929 and found that yields on issues underwritten directly by banks averaged 13 basis points higher than yields on similar issues underwritten by affiliates. This indicates that the market assessed that potential conflicts of interest were higher with direct underwriting. They also found that, over the 1920s, banks increasingly organized their securities activities in affiliates rather then keeping them in-house. It seems sensible that the market would have evolved this way, since the affiliates appeared able to guarantee higher prices to their issuing customers.

But Puri (1996) concluded that direct underwritings by commercial banks did not lead to greater conflicts of interest than underwriting via affiliates. With her sample of underwritings over the period of January 1927 to September 1929, she found that the yields at the time of issue on corporate debt issues underwritten by affiliates did not differ significantly from the yields on similar issues underwritten by investment banks, but that the yields of direct underwritings were significantly less (from 9 to 23 basis points lower, depending on the method of estimation) than those on investment bank underwritings. Similar results hold for preferred stock issues. While a test that directly compares the yields on issues underwritten in-house with those on issues underwritten by an affiliate would be more definitive, Puri's results do suggest that yields would be lower on in-house than on affiliate underwritings, given their respective relationships to yields on investment bank underwritings. This is consistent with the market's not believing that direct underwritings were subject to greater conflicts of interest than affiliate underwritings; otherwise, purchasers would have demanded higher yields on direct underwritings, not lower ones.

Since Puri's conclusions differ from those of Kroszner and Rajan, perhaps because different samples of security issues were studied, a definitive answer on the issue of organizational form awaits further study.

CONCLUSIONS

Congress has been debating whether to repeal the Glass-Steagall Act, which was passed in 1933 in the aftermath of the large number of bank failures that occurred during the Great Depression. One of the problems the act sought to address was the potential conflict of interest when a commercial bank that lends to a firm also underwrites that firm's securities.

Empirical evidence based on the pre-Glass-Steagall days and on commercial banks' recent experience in debt underwriting suggests that, on balance, conflicts of interest have not been a problem: the data support the repeal of Glass-Steagall.

APPENDIX:

A Time Line of Permissible Securities Activities

June 1988

The Fed allowed subsidiaries of commercial banks to underwrite commercial paper, municipal revenue bonds, mortgage-backed securities (as long as they weren't mortgages of an affiliated bank), and securities backed by unaffiliated banks' consumer-related receivables, subject to the revenue restriction.

1986 1987 1988 198

December 1986

The Federal Reserve issued a policy stating that government securities subsidiaries of bank holding companies may underwrite certain "bank ineligible" securities without violating Section 20 of the Glass-Steagall Act as long as the underwriting revenues from ineligible securities did not exceed 5 percent of the subsidiaries' gross revenues, since this would indicate that the subsidiary was not "engaged principally" in underwriting ineligible securities. The revenue test had to be met on an eight-quarter moving average basis. Note that even though banks were always permitted to directly underwrite U.S. government securities, if a bank wanted to underwrite ineligible securities in an affiliate, it made sense to move the underwriting of government securities to the affiliate as well, since this would increase the gross revenues of the affiliate and, therefore, the volume of ineligible securities the bank's affiliate could underwrite. To limit the possibility of conflicts of interest, the Fed included several "firewalls" (see Mester (1992a) for a discussion of these firewalls and their limitations):

1. Securities activities had to be in a subsidiary of the holding company that was separate from the commercial bank. These subsidiaries are called Section 20 subsidiaries.

2. Transactions between the affiliated bank and securities subsidiary were limited.

3. The securities and commercial bank subsidiaries could have no officers, directors, or employees in common.

4. The commercial bank subsidiary was restricted in extending loans to issuers of commercial paper placed by the securities affiliate.

5. The commercial bank subsidiary could not purchase or recommend that its customers purchase securities placed by its securities affiliate.

6. The securities subsidiary could have only limited access to customer records of the commercial bank subsidiary and could not underwrite securities issued by affiliates.

September 13, 1989

The Fed raised the limit on revenues from underwriting "bank ineligible" securities by Section 20 subsidiaries to 10 percent from 5 percent and allowed subsidiaries to underwrite and deal in securities issued by their affiliates if the securities are rated by a nationally known rating agency or guaranteed by a government agency like Fannie Mae, Freddie Mac, or Ginnie Mae.

September 20, 1990

The Fed authorized the first bank holding company, J.P. Morgan, to underwrite equities in a subsidiary of the holding company, subject to the 10 percent revenue limit.

1990 1991 1992 1993 1994

January 8, 1989

The Fed said Section 20 does not bar bank holding company subsidiaries from underwriting and dealing in corporate debt and, after a waiting period (as short as a year later) in corporate equity. To be authorized, the holding company must, among other things, be well capitalized.

The Fed authorized five large bank holding companies to underwrite corporate debt with the ruling: J.P. Morgan, Chase, Bankers Trust, Citicorp, and Security Pacific.

J.P. Morgan Securities, the Section 20 subsidiary of J.P. Morgan, Inc., did the first publicly issued corporate bond underwriting by a commercial bank affiliate in January 1989.

July 1994

The Fed sought comment on a proposal for an alternative to the revenue test that would limit underwriting of ineligible securities to 10 percent of asset value of the subsidiary or of sales volume, or both. The proposal is still alive but is on hold pending the final outcome of Glass-Steagall reform legislation.

January 1993

Several banks were reaching the 10 percent revenue limit placed on securities activities. The Fed permitted an optional method for meeting the limit: indexing the revenue test to interest rate changes. To account for changes in the level and slope of the yield curve since September 1989, the banks were allowed to calculate the revenue that would have been earned if the yield curve had been as it was in September 1989. The rationale for the change was that unusual changes in interest rates, which had occurred since 1989, had made the 10 percent revenue test more binding than it was when originally adopted. Namely, the spread between long and short rates had widened substantially. Since ineligible securities tend to be longer term than eligible securities, this meant that the 10 percent revenue limit had become more stringent even for banks that had not changed the proportion of ineligible to eligible securities they underwrote (see the *Federal Register*, 1994).

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Value at Risk: A New Methodology For Measuring Portfolio Risk

*Gregory P. Hopper**

Commercial banks, investment banks, insurance companies, nonfinancial firms, and pension funds hold portfolios of assets that may include stocks, bonds, currencies, and derivatives. Each institution needs to quantify the amount of risk its portfolio may incur in the course of a day, week, month, or year.

For example, a bank needs to assess its potential losses in order to set aside enough capital to cover them. Similarly, a company needs to track the value of its assets and any cash flows resulting from losses in its portfolio. An investment fund may want to understand potential losses on its portfolio, not only to allocate its assets better but also to fulfill its obligation to make set payments to investors. In addition, credit-rating and regulatory agencies must be able to assess likely losses on portfolios as well, since they need to set capital requirements and issue credit ratings.

How can these institutions judge the likelihood and magnitude of potential losses on their portfolios? A new methodology called value at risk (VAR or VaR) can be used to estimate these losses. This article describes the various methods used to calculate VAR, paying special attention to VAR's weaknesses.

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WHAT IS VALUE AT RISK?

Value at risk is an estimate of the largest loss that a portfolio is likely to suffer during all but truly exceptional periods. More precisely, the VAR is the maximum loss that an institution can be confident it would lose a certain fraction of the time over a particular period. Consider a bank with a portfolio of assets that would like to characterize its potential losses using VAR. For example, the bank could specify a horizon of one day and set the frequency of maximum loss to 98 percent. In that case, a VAR calculation might reveal that the maximum loss is $1 million. Thus, on average, in 98 trading days out of 100, the loss on the portfolio will not exceed $1 million over a one-day horizon. But on two trading days in 100, losses will, on average, exceed $1 million.

VAR can be used to assess the potential loss on a portfolio of assets generally. The user can specify any horizon and frequency of loss that fits his particular circumstances. But the method of calculating VAR depends not only on the horizon chosen but also on the kinds of assets in the portfolio. One method may yield good results with portfolios consisting of stocks, bonds, and currencies over a short horizon, but the same method may not work well over longer horizons such as a month or a year. If the portfolio contains derivatives, methods that differ from those used to analyze portfolios of stocks, bonds, or currencies may be needed.

VAR FOR A SINGLE SHARE OF STOCK

Ultimately, we want to calculate VAR for a general portfolio of different assets, such as stocks, bonds, currencies, and options.[1] Let's focus on the simplest case first: a single stock. A portfolio consisting of one asset will allow us to consider the different methods for assessing VAR in a simple context. Then, we can generalize the discussion by considering how the calculation changes when the institution has a portfolio of many stocks, bonds, or currencies. Finally, we will consider how the inclusion of derivatives in the portfolio can dramatically change the methodology for calculating VAR.

Randomness in the Stock Market. Let's consider a portfolio consisting of a single share of stock worth $1 at the beginning of trading today. We want to find the VAR over a one-day horizon at a 98 percent confidence level, that is, the largest one-day price drop we are likely to see on 98 out of every 100 trading days. Since VAR is essentially a statement about the likelihood of losses on a stock, we need to characterize the unpredictability of daily changes in our stock's price.

One way to picture the unpredictability of our stock's return over one day is to imagine the stock market spinning a roulette wheel. Of course, this is a fiction, but a useful one: economists have found that stock returns have a random component.

Suppose there are 100 equally likely outcomes on the wheel, with each outcome corresponding to a specific percentage daily price change or daily return for our stock.[2] In general, positive and negative returns are included on the wheel. To determine the return over one day, the stock market spins the roulette wheel. If the wheel comes up with a return of 25 percent, our stock would be worth $1.25 at the end of the day. Alternatively, a spin of the wheel may generate a return of minus 25 percent, in which case our stock would be worth $0.75 at the end of the day. We can't say for sure what the daily return will be, but we know that it will be one of the outcomes on the wheel.

[1] An option is a derivative security, i.e., its value is derived from the value of some other asset.

[2] In reality, when economists imagine stock returns on a wheel, they think of the wheel as having an infinite number of outcomes so that all possible returns are represented. To simplify the discussion, I have used 100 outcomes on the wheel as an approximation to an infinite-outcome wheel.

Finding the VAR for our $1 stock is particularly simple if we know the returns on the roulette wheel. Suppose we look at the outcomes on our roulette wheel and see that 98 of them involve returns bigger than minus 30 percent while two outcomes have returns smaller than minus 30 percent. Then we have found the VAR for our $1 stock: the VAR is $0.30 at a 98 percent confidence level. We can be confident that 98 days out of 100 our daily stock loss will be no bigger than $0.30. But two days out of 100, the daily loss may indeed exceed $0.30.

Summary Measures of Randomness. To find the VAR for our stock, we needed to know the 100 returns on the wheel. But how do we know what they are? Imagine that, every day, the market is spinning the wheel behind a curtain. We can't see the outcomes on the wheel, but we do know which daily returns were selected in the past—we can look them up in the newspaper. By categorizing past daily returns, we should be able to infer the outcomes on the wheel. For example, if we saw that daily returns of 10 percent occurred on five trading days in 100, on average, we can assume that five outcomes on the wheel involve a 10 percent return. Similarly, if changes of minus 5 percent occurred on 10 trading days in 100, on average, a return of minus 5 percent must correspond to 10 outcomes on the wheel. By continuing this analysis, we can associate price changes with all outcomes on the wheel. Then we will have reconstructed the wheel that the economy spins daily. Using our reconstructed wheel, we can easily find the VAR.

A simpler way to do this reconstruction is to summarize the 100 returns on the wheel by using two numbers: the average return (mean) and the volatility (variance) of the returns. Elementary statistics teaches that if the returns follow a certain pattern, called the normal, or bell-shaped, distribution, all the outcomes on the wheel can be summarized by these two numbers.

We can estimate the average return as an equally weighted average of past daily returns selected by the roulette wheel, returns that, again, could be looked up in the newspaper. For technical reasons, analysts often don't perform this calculation but assume instead that the average return is zero.[3] The second number, the volatility, tells us how much the return is likely to deviate from its average value for any particular spin. The volatility, then, measures the capacity of the roulette wheel to generate extreme returns, whether positive or negative, with respect to the average value of zero. The higher the volatility of the roulette wheel, the more it tends to select large returns. We can estimate the volatility as an equally weighted average of past squared returns. We could use the same returns we looked up in the newspaper; we only need to square each change.

Armed with the average return of zero and the volatility of our stock's returns, we can find the VAR over a one-day horizon at the 98 percent confidence level by following a simple procedure. To calculate VAR for our stock, we need only multiply today's stock price of $1 times the square root of the volatility times a number corresponding to the 98 percent confidence level, called the confidence factor. The confidence factor is derived from the properties of the normal distribution. At the 98 percent confidence level, it equals 2.054.[4]

This procedure can be done on any day in

[3]Since the average return is estimated very imprecisely, it may pay to set it to zero to avoid corrupting the rest of the VAR analysis. For more discussion on setting the average return equal to zero, see the article by Steven Figlewski and the 1995 article by David Hsieh.

[4]From elementary statistics, 2.054 standard deviations leave 2 percent of the normal distribution in its left tail, which corresponds to stock losses occurring 2 percent of the time. If the confidence level were 95 percent, the confidence factor would be 1.65, because 1.65 standard deviations leave 5 percent of the normal distribution in the left tail.

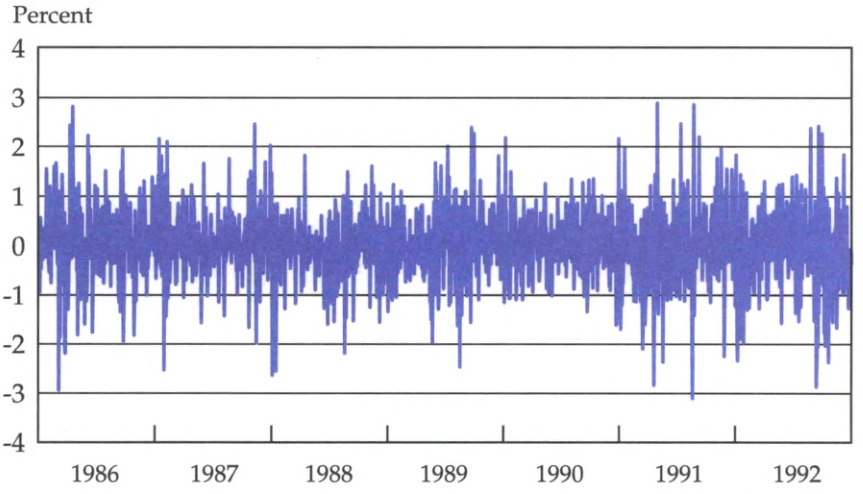
the future as well. Let's assume that it's now tomorrow and the stock price is $0.95. If we wanted to calculate VAR, we would follow the same procedure as before but use a stock price of $0.95. We don't need to change the volatility or the confidence number: they don't vary from day to day. When VAR is calculated in this fashion, we are using a constant volatility method.

Time-Varying Volatility. The problem with the constant volatility method is that substantial empirical evidence shows volatility is not constant from day to day but rather varies over time.[5] A look at a graph of the daily dollar return on the deutsche mark shows that volatility tends to cluster together (Figure 1). Notice that highly volatile times, characterized by large up-and-down swings in the exchange rate, tend to follow one another, while quiet periods, characterized by smaller up-and-down swings, tend to follow each other as well. For example, volatility seems to have been higher in 1991 than in 1990. A graph of the daily return on the S&P 500 confirms this impression for stock prices (Figure 2). The increase in volatility is particularly apparent after the stock market crash in 1987. Time-varying volatility seems to be a general feature of asset prices that is seen not only in currencies but also in stocks. Consequently, using the constant volatility method to calculate VAR could be very misleading.

What does time-varying volatility mean for our roulette wheel analogy? When the average return and the volatility don't vary from day to day, the returns on the wheel don't vary either. Thus, the market is spinning the same roulette wheel every day. But if the volatility is changing from day to day (time-varying volatility), the returns on the wheel must also be changing; therefore the market is spinning a

[5]The evidence suggests that volatility is time-varying for short horizons such as up to a week or 10 days. For longer horizons, the evidence for time-varying volatility is weaker. If a firm is interested in calculating VAR over a much longer horizon, the time-varying volatility issue may not be so important.

FIGURE 1
Daily Percent Dollar Return on Deutsche Mark



different wheel each day.

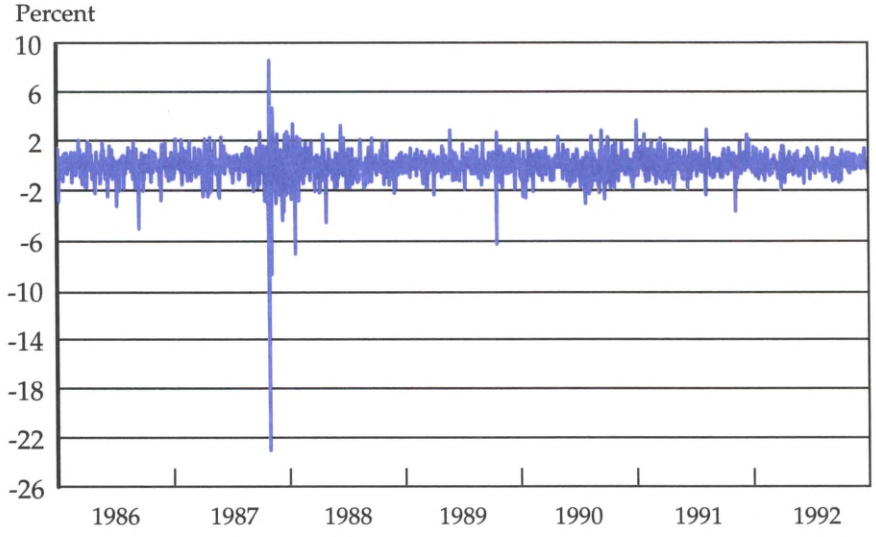
If the market spins a different roulette wheel every day, VAR becomes more complicated. How do we know which returns will be on the wheel today? Equivalently, how do we know today's volatility? The most common solution to this problem was introduced in 1986 by economist Tim Bollerslev, who generalized work done by economist Robert Engle in 1982. Bollerslev's time-varying volatility technique, called the GARCH method, allows us to base our knowledge of today's roulette wheel on yesterday's wheel.

Bollerslev's GARCH technique estimates the volatility of today's roulette wheel using yesterday's estimate of volatility and the squared value of yesterday's return. If yesterday's return was large, in either a positive or negative direction, and yesterday's volatility was high, today's roulette wheel will tend to have a high volatility. Thus, today's spin of the wheel will tend to produce large returns as well. In this way, large returns, positive or negative, would tend to follow one another, leading to periods of high and low volatility as we saw in Figures 1 and 2.

How can we estimate today's volatility and find the VAR using Bollerslev's GARCH method? The daily volatility using GARCH turns out to be a weighted average of past squared returns, just as it was in the constant volatility case. The difference is that the constant volatility method weights past squared returns equally while Bollerslev's GARCH method weights recent squared returns more heavily than distant returns.

It is easy to calculate volatility using the constant volatility method. Bollerslev's GARCH method is much harder to implement: to find the right weight for each past squared return, we must employ a complicated, computer-intensive procedure. Once we have found today's volatility, we can multiply the confidence factor times the square root of today's volatility times today's stock price to find today's VAR. When we use Bollerslev's GARCH method, the

FIGURE 2
Daily Percent Dollar Return on S&P500



confidence factor is the only number that does not change daily.

RiskMetrics™. Bollerslev's GARCH method has found widespread empirical support among financial economists, but the difficulty in estimating daily volatilities has slowed its adoption by many institutions engaged in risk management. To make the calculations easier, J.P. Morgan introduced RiskMetrics™, a risk management system that includes techniques to approximate GARCH volatilities (see *Pros and Cons of Using RiskMetrics™ as a Risk-Management Tool*). Like Bollerslev's method, the RiskMetrics™ estimate of daily volatility involves a weighted average of past squared returns, with recent squared returns weighted more heavily. The RiskMetrics™ weights are chosen to produce daily volatility estimates similar to GARCH volatilities. The set of weights calculated by the RiskMetrics™ method is easier to compute and can be used for any asset in the portfolio. For example, the analyst would use the same set of weights to calculate volatilities of stocks, bonds, and currencies. Bollerslev's GARCH method, in contrast, requires the computation of different weights for each volatility calculation, and each set of weights is harder to calculate than it would be using the RiskMetrics™ method.[6]

Other Methods. Two other methods of calculating volatility are sometimes used. The first method relies on recognizing that pricing methods for options require the user to specify his estimate of the future volatility of an asset. For example, if a user wants to price an option on a stock using a method such as the popular Black-Scholes method, he must specify an estimate of the volatility of the stock over the life of the option.[7] Since option prices are observable in

[6]Under the RiskMetrics™ method, a different set of weights is calculated for each of a series of over 400 assets. The weights are then combined to yield a single composite set of weights that can be used for any asset in the portfolio.

Pros and Cons of Using RiskMetrics™ as a Risk-Management Tool

Pros

- Computationally convenient approximation to Bollerslev's GARCH method. Thus, will require relatively smaller investment in research and information systems.
- Not a proprietary system The methodology is explained in detail in J.P. Morgan publications.
- J.P. Morgan publishes volatilities and correlations on a wide variety of assets free of charge.
- Substantial third-party software support.

Cons

- Commits user to a one-size-fits-all method: the GARCH method. This may be misleading for stocks, especially following large changes in stock prices. GARCH may also not describe covariances well.
- There is no consensus on how well GARCH models forecast volatility. Even if GARCH models forecast volatility well in a statistical sense, that is, make small forecast errors, they may not forecast well in an economic sense. For example, the RiskMetrics™ volatility estimate may not maximize profits even if it does forecast volatility well in a statistical sense.
- VAR may be the wrong methodology for the firm.

the marketplace, the market's view of volatility can be backed out of the option price using the Black-Scholes formula. Volatility estimates inferred from option prices in this way are called implied volatilities.

This method has two disadvantages that limit its appeal. First, options may not be traded on the particular asset of interest. Thus, implied volatility estimates may not be obtainable for some assets in the portfolio. Second, economists are unsure about whether implied volatility estimates are better than GARCH estimates of daily volatility.

The other method of estimating volatility is based on judgment. The user analyzes the economic environment and forecasts volatility based on his subjective views. This method has limited appeal as well, since testing the validity of a subjective view is difficult.

VAR FOR A PORTFOLIO OF ASSETS

Up to this point, we have considered only how to calculate the VAR of a portfolio consisting of a single stock. Now let's look at a portfolio of two stocks. The principles we are about to discuss apply generally to portfolios of many assets, but we will consider just two stocks to make the ideas clear.

As before, ultimately we want to find the volatility of the return on the portfolio. It's clear that the volatility of the portfolio should depend on the volatility of the return of each stock in the portfolio. So, we need to estimate the volatilities of the returns of both stocks. But stock returns may covary as well. For example, if the covariance between the stocks in a portfolio of two stocks is negative, then when one stock has a positive return, the other has a negative return, and vice versa. Thus, the two stocks dampen each other's swings in return, producing a portfolio whose volatility is lower than the volatility of each stock in the portfolio. Adding more stocks to the portfolio would reduce the volatility further, provided the additional stocks' returns are not highly positively correlated with the return of the initial portfolio. To account for this effect, we must also estimate the covariance between the stocks' returns. Once we know the stock returns' volatilities and covariances, we can calculate the volatility of the entire portfolio and find the VAR as before.

As an example of the calculation, suppose we have invested $1 in stocks 1, 2, and 3. Then by an elementary statistical formula, the daily volatility of the portfolio would be

volatility(portfolio) = volatility(stock 1) +
volatility(stock 2) + volatility(stock 3) +
2.0 x covariance(stock 1, stock 2) +
2.0 x covariance(stock 1, stock 3) +
2.0 x covariance(stock 2, stock 3)

Notice that if the covariance between the daily returns of stocks 1, 2, and 3 were zero, we could sum the volatilities of each stock to get the volatility of the portfolio. Thus, if covariances between all assets were zero, we could find the VAR of each asset separately and then sum them to get the VAR of the portfolio. But since covariances are, in general, not zero, we can't, in general, find the VAR of individual assets and sum them to get the VAR of the portfolio. Moreover, we can't find the VARs of asset classes such as stock and currency portfolios separately and sum them. We must account for the covariances between asset classes as well.

To calculate covariances between the assets' returns using the constant covariance method, we use an equally weighted average of the products of each stock's past daily returns. However, since economists have found evidence that covariances change over time, it may be advisable to estimate time-varying covariances using an extension of Bollerslev's

[7]For an explanation of this method, see the article by Fischer Black and Myron Scholes.

GARCH method or the RiskMetrics™ GARCH approximation.[8]

WHAT ABOUT DERIVATIVES?

Many portfolios have significant numbers of derivatives such as futures, options, and swaps, all of which are securities whose value is derived from the value of some other asset. Consider a derivative on our $1 stock. We know how to find the VAR of the stock over a one-day horizon at the 98 percent confidence level: we find the volatility of its return and multiply its square root by the product of today's stock price and the confidence factor. But how can we find the VAR of a derivative on this stock?

One method is to link the derivative to the underlying stock and use the standard VAR method. To do this, we use a derivative-pricing method, such as the Black-Scholes model, to calculate a number called delta, which gives us a way to translate the derivative portfolio into the stock portfolio. A derivative's delta tells us how the derivative's price changes when the stock price changes a small amount. For example, if the delta is 0.5, the derivative's price goes up half as much as the stock's price. For small price changes, a derivative with a delta of 0.5 behaves as if it is half a share of the $1 stock. So, using our estimate of the stock's volatility, we could calculate VAR as before: by multiplying $0.50 times the square root of the stock's volatility times the confidence factor.

A serious drawback to this method is that it works well only when stock price changes are small. For larger changes, delta itself can change dramatically, leading to inaccurate VAR estimates. In general, we need to account for how delta changes, considerably complicating the analysis.

To avoid this complication, risk managers often use an alternative method called Monte Carlo analysis. Using the volatility and covariance estimates for the derivatives' underlying assets as well as a derivative pricing tool such as the Black-Scholes method, risk managers construct a new roulette wheel. The new wheel will still have 100 numbers, but each number will correspond to a potential change in the derivative's price. The computer can then look at the largest loss the derivative will sustain for 98 of the outcomes. Let's suppose this loss is $0.01. Then the VAR of the derivative over a one-day horizon at the 98 percent confidence level is $0.01. Since RiskMetrics™ yields volatility and covariance estimates, Monte Carlo evaluation of derivative portfolios can be done under J.P. Morgan's system as well.[9]

WEAKNESSES OF VAR

When properly used, VAR can give an institution an idea about the maximum losses it can expect to incur on its portfolio a certain fraction of the time, making VAR an important risk-management tool. Using VAR calculations, an institution can judge how it should reallocate the assets in its portfolio to achieve the risk level it desires. But VAR methodology is not without its weaknesses, and, improperly used, it may lead an institution to make poor risk-management decisions. This can happen for one of two reasons: either the VAR is incorrectly calculated or the VAR is correctly calculated but irrelevant to the institution's real risk-management goals.

What Is the Best Method for Estimating Volatility? Bollerslev's GARCH method works better for currencies than it does for stock prices. Financial economists have found that stock volatility goes up more as a result of a large negative return than it does as a result of a large

[8]For further discussion on covariance GARCH techniques, see the paper by Robert Engle and Kenneth Kroner and the 1990 paper by Tim Bollerslev.

[9]For more detail on this process, see the RiskMetrics™ technical document. For an example of a related methodology, see the 1993 articles by David Hsieh.

positive return. A weakness of Bollerslev's GARCH method is that GARCH volatility estimates don't depend on whether yesterday's return was positive or negative. Thus, this method can't allow for stock volatility's asymmetric response to past returns.

To account for this effect, financial economists have developed methods for estimating asymmetric volatilities.[10] These methods are important because they can give very different estimates of volatility for days following large stock returns than would the GARCH or RiskMetrics™ method. For small daily returns, Bollerslev's method, RiskMetrics™, and the asymmetric volatility method yield similar one-day-ahead volatility predictions, leading a user to think, perhaps, that one model is as good as the others for daily volatility predictions. But for large daily returns, the one-day-ahead volatility predictions of these methods can be substantially different. If an asymmetric volatility method is appropriate for stock prices, both Bollerslev's method and RiskMetrics™ may understate one-day-ahead volatility whenever a large drop in stock prices occurred the previous day, thus producing a potentially substantial underestimate of daily VAR. Similarly, the GARCH or RiskMetrics™ method could overestimate the VAR after a large increase in stock prices.

Robert Engle and Victor Ng have provided evidence that a particular asymmetric volatility method well describes the volatility of Japanese stock returns and that GARCH methods can substantially underpredict volatility following large negative returns. Thus, VAR estimates of stock portfolios produced by GARCH or the RiskMetrics™ GARCH approximation should be viewed with caution if the calculations are done on days with large stock returns.

Although having the right method for calculating the volatilities of assets is important, correctly calculating the covariances between the returns on assets is also important. Unfortunately, not as much work has been done by financial economists to identify the right method for calculating covariances. To date, many methods have been proposed, but no consensus has yet emerged. Thus, we don't yet know for sure how we should handle covariances in portfolios. This uncertainty introduces the risk that any method we use may substantially under- or overestimate VAR. In particular, RiskMetrics™ commits the user to a special case of Bollerslev's GARCH method. Since we don't yet know whether Bollerslev's GARCH method is adequate in describing covariances, we should use even more caution in interpreting results whenever we have used covariances in our VAR calculations.

In the long run, the volatility estimates produced by GARCH methods tend, in general, to approach the values that the constant volatility method would have calculated. Thus, for horizons much longer than one day, using the constant volatility method to calculate VAR may be warranted.[11]

Frequency of Large Returns. Using either Bollerslev's GARCH model or the constant volatility method, we could find the VAR by assuming that the returns on the wheel follow a normal distribution. However, a substantial amount of evidence indicates that the normal distribution is inadequate because large daily returns, positive or negative, occur more often in the market than a normal distribution would suggest. One remedy is to use a different distribution for the price changes, one that generates more frequent large returns.[12] Alternatively,

[10]The prototypical asymmetric volatility model is EGARCH. See the article by Daniel Nelson.

[11]See the article by David Hsieh (1993a) for a discussion about when the constant volatility model may be appropriate.

[12]For an example of this technique, see the article by Daniel Nelson.

we could use statistical methods that assume the returns follow the normal distribution, but which remain valid even if this assumption is mistaken.

Whichever method we use, we are essentially looking at the past frequencies and magnitudes of returns and attempting to represent them on a reconstructed wheel. Even if we account for the nonnormality of returns during this process, there is still a problem: we're going to put on the wheel only those returns we saw in the past with the frequency we saw in the past. So, if some potential negative returns are rare or have not yet occurred, we may underrepresent them on the wheel, implying that the VAR will be underestimated.

Structural Shifts in the Economy. VAR may be underestimated if the wheel the market is spinning suddenly changes in an unpredictable way because of a structural change in the underlying economy. For example, consider the European Exchange Rate Mechanism (ERM), which kept daily returns of major European currencies small. In 1993, in response to economic pressures, much larger returns were suddenly allowed. Thus, the volatility of the returns suddenly shot up faster than Bollerslev's GARCH method would have forecast based on past volatilities and returns. If we had calculated the VAR the day before the shift, we would have underestimated it because we would have used an estimate of the volatility that was too low. More subtly, since we never know when the economy may suddenly shift to higher or lower volatility as a result of a structural change, we will incorrectly estimate the VAR unless we explicitly account for this possibility.

Because of the problems caused by infrequent large returns and structural shifts in the economy, it seems prudent, then, to supplement statistical calculations of VAR with judgmental estimates. For example, an institution could have asked its economists to project the likely price effects if the ERM suddenly allowed larger price changes. These projections could be based on similar historical episodes, economic theory, and empirical experience. VAR estimates based on judgment could be generated for changes in central bank monetary regimes, political instability, structural economic changes, and other events that have either never happened or happen infrequently.

Liquidity of Assets. VAR measures the maximum loss that an institution can expect a certain fraction of the time over a specific horizon. Losses are measured by assuming that the assets can be sold at current market prices. However, if a firm has highly illiquid assets—meaning that they cannot quickly be resold—VAR may underestimate the true losses, since the assets may have to be sold at a discount.

Credit Risk. Another potential problem for VAR is that the methods used to evaluate the assets in the portfolio may not properly treat credit risk. Suppose a bank buys a portfolio of derivatives from many different firms. The derivatives are valuable to the bank because they impose obligations on the firms. For example, one of the derivatives may obligate a firm to sell foreign currency to the bank at a price below the current market price, yielding a profit to the bank under some conditions, but it may also obligate the bank to deliver foreign exchange at a below-market price under other conditions. Using the Black-Scholes method and a Monte Carlo simulation, which assume no derivative credit risk, the bank calculates a VAR of $5 million at a 98 percent confidence rate for a three-month horizon. But if some of the firms may default on their obligations, the true value of these derivatives is lower than would be estimated by the Black-Scholes method coupled with Monte Carlo analysis. Thus, the true value at risk is larger than $5 million. To account for this possibility when valuing derivatives, the bank should use a method that includes credit risk. For some applications, credit risk may be small enough to ignore, but, in general, users need to include

credit risk analysis in their VAR methods.

Is VAR the Right Methodology? In many situations, VAR may not be the correct risk-management methodology. If we pick a specific loss such as $1 million, VAR allows us to estimate how often we can expect to experience this particular loss. For example, using VAR we might estimate that we will lose at least $1 million on one trading day in 20, on average. During some 20-day periods, we might lose less than $1 million. During other 20-day periods, we might lose more than $1 million on more than one day. VAR tells us how often we can expect to experience particular losses. It doesn't tell us how large those losses are likely to be. In particular, in any 20-day period, there is always one day on which the worst loss is experienced. If we want to know the size and frequency of the worst loss, VAR provides no guidance.

One way of handling this is to use worst-case-scenario analysis (WCSA), proposed by Jacob Boudoukh, Matthew Richardson, and Robert Whitlelaw. WCSA might show that on the day with the worst price change in a 20-day period, we can expect to lose at least $2.77 million 5 percent of the time, a number substantially bigger than $1 million. Thus, if a firm is interested in the size of a worst-case loss, VAR could underestimate it.

CONCLUSION

VAR is an important new concept in portfolio risk management. It gives the maximum loss that an institution can expect to lose with a certain frequency over a specific horizon, and it can be calculated by using a constant volatility or time-varying volatility method. There are, however, problems in implementation and interpretation. To implement VAR calculations, it is important to use the right method, especially under unusual circumstances such as stock market crashes. Although much progress has been made in describing how volatilities change through time, not as much progress has been made in the description of time-varying covariances. Thus, VAR numbers should be viewed with caution at this point.

Besides the problem of identifying the right method, VAR measures may mislead unless they properly account for liquidity risk, rare or unique events, and credit risk. In many situations, it may not be the right risk-management concept. An institution may want to investigate an alternative, such as worst-case-scenario analysis.

Despite the contribution that VAR can make to a firm's understanding of the risks in its portfolio, these risks can be misunderstood if they are not communicated effectively to a management that understands the value and limitations of sophisticated financial technology. Poor management practices, which could lead to unauthorized trades, may also contribute to this misunderstanding. Thus, a firm should use VAR in the context of a broader risk-management culture, fostered not only by the firm's risk managers but also by its senior management.

APPENDIX
VAR and Capital Requirements for Market Risk

In 1995, the Basle Committee on Banking Supervision at the Bank for International Settlements (Basle Committee) issued a proposal for comment entitled "Internal Model-Based Approach to Market Risk Capital Requirements." This proposal would establish a VAR-based method of measuring banks' portfolio risk. In January 1996, the Basle Committee approved an approach that would allow banks to use their own internal risk-management models or the Basle Committee's standard model. The internal risk-management models would be subject, however, to qualitative and quantitative restrictions. U.S. regulators are expected to implement this approach for nine or 10 of the largest U.S. banks. Some examples of the restrictions the Basle Committee would impose on internal models are:

Quantitative Criteria:

- VAR must be computed daily using a horizon of 10 trading days.
- The confidence level should be set to 99 percent.
- Models should account for changing delta when computing VAR. In addition, VAR models should account for the impact of time-varying volatility on option prices.
- Banks may use covariances within and across asset classes.

Qualitative Criteria:

- Banks should have independent risk-management units that report directly to senior management.
- VAR reports and analyses should be considered when setting trading limits.

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