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AGGREGATE BANK PORTFOLIO STATISTICS

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# Research Paper



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# A NOTE ON THE INADEQUACY OF AGGREGATE BANK PORTFOLIO STATISTICS

by

Sydney Smith Hicks\*

Economists often describe individual bank portfolio behavior and characterize it by utilizing statistics computed from bank data averaged over the entire banking system. Since the banking system contains very small banks, as well as very large banks, statements about the average bank may well represent neither the small nor the large bank situation. In such a case, theorizing about bank portfolio behavior based on these aggregates could leave economists with a theory describing a nonexistent constituency.

In order to investigate whether or not the aggregate data measuring bank portfolio behavior accurately describe large as well as small bank behavior, cross-section data from the Federal Reserve System's Call Reports for approximately 15,000 insured commercial banks are examined from June 1969 to September 1978. The portfolio statistics utilized in this study include the ratio of loans, securities, and Federal funds to total loans and investments.

The main result of this study is that the aggregate portfolio statistics are not adequate to proxy the state of the microbanking environment due to the diversity of the banking industry. Although the construction of the aggregate portfolio statistics gives large weight to the largest banks, the levels of aggregate portfolio ratios are not even representative of the largest banks. Moreover, the movements of these aggregate ratios are not generally representative of the portfolio adjustment taking place in the banking system over the business cycle.

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### The General Level of Portfolio Ratios

Aggregate portfolio data are useful summaries of individual banks if all banks are sufficiently similar. Table 1 through Table 3 display the percentage portfolio allocations between loans, securities, and Federal (Fed) funds.<sup>1/</sup> As can be seen, the allocations in each deposit category are sometimes quite different from the total all bank averages.

The data suggest that as banks increase in deposit size, the allocation of earning assets to the loan category increases (Table 1). Most banks have less proportionately in loans than the aggregate loan percentage indicates. In 1969 banks with total deposits of at least \$2 but less than \$5 million had a loan allocation 25 percent less than the all bank percentage.

With respect to the investment of earning assets in securities (Table 2), the percentage declines as bank deposit size increases. The deposit categories for the smaller banks tended to have proportionately more in securities than the all bank aggregate, while the deposit categories for the larger banks tended to invest proportionately less. In 1969 banks with at least \$2 but less than \$5 million in deposits invested over 40 percent more in securities than indicated by the all bank security percentage.

The pattern of investments in Fed funds displays a much less predictable pattern (Table 3). While one might expect that the percentage falls as bank size increases (due to the notion that small banks "upstream" their funds to the larger banks where the funds are invested), this is not the case. In the late 1960's and early 1970's, the Fed funds percentage fell as bank size increased until deposits equalled or exceeded \$100 million but were less than \$300 million. Beyond that point the Fed funds percentage increased until bank size reached \$1,000 million. For banks with deposits in excess of \$1,000 million, the ratio declined to

its lowest value. This pattern has changed somewhat in the late 1970's (see the last column in Table 3). Banks with deposits greater than or equal to \$25 million and less than \$100 million allocate the least amount of funds to Fed funds investment, while banks which are smaller and larger allocate more percentage-wise to that category.

Are the observed differences "significant?" The answer obviously depends on what is deemed significant. We cannot appropriately use the concept of statistical significance here because we have the entire population of banks, not a sample of them. Nevertheless, because many people tend to identify as significant differences only those that are statistically so, it is natural to wonder how the observed differences compare to those that would be considered statistically significant if we were dealing with a sample.

Let us proceed, therefore, as if the data were a sample and "test", for example, whether the observed difference between the all bank loan percentage and the loan percentage in banks with deposits of a particular size is significantly different from zero. Because there are three portfolio percentages and ten deposit categories, there are 30 such tests. If we find that the observed differences are "statistically insignificant" in every case, we will consider the all bank data sufficiently representative and will cease to worry about the information lost in the aggregation. On the other hand, if we find "statistically significant" differences, we can conclude that aggregation is apt to provide misleading information.

In general, the average observed differences are "significantly" different from zero at the 95-percent confidence level.<sup>2/</sup> Table 4 contains the differences by deposit category averaged over the period June 1969 through September 1978. The all bank ratios communicate very little information about

the levels of the portfolio ratios in the individual deposit categories. Only for banks in one deposit category ( $300 \leq TD < 500$ ) did the portfolio ratios not "significantly" differ from the all bank percentages.

While these results may not be surprising for the small banks, the results for the banks with deposits equal to or greater than \$500 million are another case. Because large banks' assets are such a large part of the data base from which the average asset percentages are derived for all commercial banks, we might have expected that the aggregate asset percentages to proxy on average the large bank portfolio behavior.<sup>3/</sup> This expectation is simply not confirmed. Consequently, anyone desiring to summarize bank portfolio behavior by utilizing only aggregate portfolio percentages should be aware that the portfolio diversity in the banking system limits the usefulness of the aggregate numbers in characterizing individual bank portfolio behavior as represented here by the different deposit categories.

#### The Cyclical Variability of the Portfolio Ratios

From the aggregate portfolio percentages of all banks, economists have noted that the percentages tend to vary with the business cycle. For example, if the economy is moving towards a peak in the business cycle, business firms need relatively more financing than before because profit margins tend to shrink as production facilities strain at capacity production levels. As profit margins shrink, cash flows used to finance the production fall relative to what is needed, and business firms seek bank loans. Despite a shrinking loan-security interest rate differential as a business cycle peak approaches, in the aggregate banks move more funds into the loan category relative to securities and Fed funds. Similarly, when the economy is slowing down in a recession, banks reallocate their assets away from loans and towards other investments.<sup>4/</sup>

The aggregate loan ratio displays the procyclical behavior discussed above (Table 1), while the aggregate security ratio displays the countercyclical behavior discussed above (Table 2). The aggregate Federal funds ratio does not seem to indicate any particular cyclical pattern (Table 3). Instead, there seems to have been a secular trend towards increased Fed funds investment until the recent period when the ratio declined.5/

Although the general level of the aggregate ratios is not informative about the state of the portfolio in small or large bank categories, does the movement (in percentage terms) of these aggregate ratios summarize movement of the portfolios in the individual deposit categories? For the ten deposit ranges the mean percentage changes between the peak-trough and trough-peak time periods are displayed in Table 5 for all three portfolio ratios. Again, let us proceed as if the data were a sample and "test" the hypothesis that the mean percentage change for each of the ten deposit categories equals the percentage change for the aggregate bank data. The t-statistics for the hypothesis being tested are in parentheses in Table 5. For example, in the 1969-1970 period the all bank loan percentage declined 4.85 percent while the average category decline was 3.33 percent. We can be 80 percent confident that the 1969-1970 average movement in the ten deposit categories was "significantly" different from that amount represented by the all bank loan data.6/

In general, movement of the aggregate loan percentage provides the least information of the three portfolio statistics about the behavior of the loan percentages in the ten deposit categories, while movement of the aggregate Fed funds percentage provides relatively the most information. Interestingly, the average category movements in all three ratios during the 1973-1975 peak-trough period were not "significantly" different from the all bank ratio movements. However, in every other period the portfolio adjustment of at least one of the asset ratios would have been misrepresented.

Table 1

Loan Percentages Over  
the Business Cycle by  
Deposit Category.

TOTAL DEPOSIT (TD) CATEGORY (MILLIONS)	12/69 (P)	12/70 (T)	12/73 (P)	4/75 (T)	9/78
TD < 2	50.6	51.6	44.1	48.7	51.8
2 ≤ TD < 5	54.4	54.4	51.9	53.5	61.2
5 ≤ TD < 10	56.4	55.6	55.1	55.1	63.5
10 ≤ TD < 25	58.5	56.9	58.0	57.2	64.9
25 ≤ TD < 50	62.3	59.5	61.6	59.2	65.4
50 ≤ TD < 100	63.1	60.6	62.5	60.5	65.8
100 ≤ TD < 300	66.4	63.6	64.5	61.9	65.6
300 ≤ TD < 500	69.9	65.5	67.8	66.2	66.4
500 ≤ TD < 1000	70.4	66.5	67.9	66.8	67.4
TD ≥ 1000	75.8	70.8	74.4	74.6	73.6
TOTAL	67.9	64.6	67.4	66.4	69.0



Table 2

Security Percentages Over  
the Business Cycle by  
Deposit Category

TOTAL DEPOSIT (TD) CATEGORY (MILLIONS)	12/69 (P)	12/70 (T)	12/73 (P)	4/75 (T)	9/78
TD < 2	45.2	43.8	34.0	33.7	30.1
2 ≤ TD < 5	42.1	41.8	37.0	36.3	32.0
5 ≤ TD < 10	39.8	40.3	37.0	36.6	31.4
10 ≤ TD < 25	38.1	39.0	35.9	35.3	31.4
25 ≤ TD < 50	35.2	36.5	33.8	33.8	31.4
50 ≤ TD < 100	34.6	35.6	32.7	33.4	31.0
100 ≤ TD < 300	31.6	33.1	30.1	31.7	30.7
300 ≤ TD < 500	28.1	29.9	27.4	26.9	29.5
500 ≤ TD < 1000	26.8	29.4	26.0	26.8	28.1
TD ≥ 1000	22.6	26.6	21.5	21.2	21.6
TOTAL	29.8	31.9	27.6	27.8	26.8

Table 3

Federal Funds Percentages Over  
the Business Cycle by  
Deposit Category

TOTAL DEPOSIT (TD) CATEGORY (MILLIONS)	12/69 (P)	12/70 (T)	12/73 (P)	4/75 (T)	9/78
TD < 2	4.2	4.7	21.9	17.6	18.1
2 ≤ TD < 5	3.6	3.7	11.1	10.2	6.9
5 ≤ TD < 10	3.7	4.1	8.0	8.3	5.1
10 ≤ TD < 25	3.4	4.1	6.1	7.5	3.7
25 ≤ TD < 50	2.6	4.0	4.6	7.0	3.2
50 ≤ TD < 100	2.4	3.8	4.8	6.1	3.2
100 ≤ TD < 300	2.0	3.3	5.4	6.5	3.7
300 ≤ TD < 500	2.0	4.6	4.8	6.9	4.1
500 ≤ TD < 1000	2.7	4.1	6.1	6.4	4.5
TD ≥ 1000	1.6	2.6	4.0	4.2	4.8
TOTAL	2.3	3.5	5.0	5.8	4.2

Table 4

Average Difference Between  
All Bank Percentages and  
Deposit Category Percentages  
June 1969-September 1978

Deposit Category (millions)	Loan Percentage*	Security Percentage	Fed Funds Percentage
TD < 2	16.37 (20.69)	-6.51 (-11.49)	-9.86 (-9.71)
2 ≤ TD < 5	10.68 (17.26)	-7.80 (-18.33)	-2.89 (-7.87)
5 ≤ TD < 10	9.02 (16.38)	-7.46 (-19.46)	-1.55 (-7.60)
10 ≤ TD < 25	7.40 (18.10)	-6.81 (-23.96)	-0.59 (-4.27)
25 ≤ TD < 50	5.47 (23.83)	-5.69 (-35.99)	0.23 (2.00)
50 ≤ TD < 100	4.51 (23.85)	-5.05 (-37.95)	0.55 (5.28)
100 ≤ TD < 300	3.09 (18.09)	-3.29 (-22.08)	0.20 (2.68)
300 ≤ TD < 500	0.47 (1.81)	-0.36 (-1.39)	-0.12 (-1.22)
500 ≤ TD < 1,000	-0.72 (-3.66)	1.23 (7.43)	-0.51 (-3.65)
TD ≥ 1,000	-6.55 (-26.17)	6.24 (38.75)	0.31 (2.55)

\* Amounts in parentheses are t statistics.

Table 5

Mean Percentage Change of the Ten Deposit  
Categories over the Business Cycle

PERIOD	MEAN PERCENTAGE CHANGE*		
	LOANS	SECURITY	FED FUNDS
1969-1970 (Peak-Trough)	-3.33 (1.74)	4.47 (-1.48)	47.24 (-0.24)
1970-1973 (Trough-Peak)	0.05 (-2.30)	-11.35 (1.36)	92.14 (1.33)
1973-1975 (Peak-Trough)	-0.27 (0.88)	0.19 (-0.59)	14.53 (-0.20)
1975-1978 (Trough-Current)	7.45 (1.89)	-4.89 (-0.63)	-31.92 (-0.53)

\* The t-statistics in parentheses are calculated with the value of beta in the maintained hypothesis equal to the percentage change in the total bank portfolio statistics for the specified period. The betas can be obtained from the data in Tables 1-3.

## FOOTNOTES

1. Table 1 through Table 3 contain the proportions of funds in loans, securities, and Fed funds for all insured commercial banks in the United States, divided into ten deposit ranges; the last row in each table contains the portfolio percentage for the aggregate bank data. Except for the most recent data, the portfolio ratios have been selected for the reporting dates closest to the peak (P) and trough (T) months of the business cycle.
2. Based upon a two-tailed t-test, the hypothesis can be rejected with confidence at the 99-percent level if the  $|t| \geq 2.75$  and at the 95-percent level if  $|t| \geq 2.04$ .
3. The new panel of banks reporting weekly to the Federal Reserve includes 171 banks with assets of \$750 million on December 31, 1977. These banks hold approximately 49 percent of total assets in the banking system and 48 percent of total loans.
4. In an extensive study of commercial bank behavior, Wood (1) suggests that a dynamic theory of commercial bank portfolio behavior which incorporates the bank-customer relationship can explain these empirical regularities.
5. Of course the composition of each deposit category has changed over the late 1960's and 1970's. The effect of inflation in the 1970's has been to push banks into the larger deposit categories. As a result, the importance of start-up situation banks for the portfolio statistics of banks less than \$5 million in deposits has grown. To some extent this increased proportion of start-up situations explains the relatively large proportion of Fed funds and relatively small proportion of loans and securities in the portfolios of banks less than \$5 million in the 1970's.
6. Based upon a two-tailed t-test, the hypothesis can be rejected with confidence at the 90-percent level if the  $|t| \geq 1.81$  and at the 80-percent level if  $|t| \geq 1.37$ . Because the beta in the maintained hypothesis may sometimes be larger than the mean being tested, it is possible that some of the t-statistics will be negative when the mean is positive. Of course the mean percentage change for the ten deposit categories effectively weights smaller banks more heavily than the all bank average. If small and large banks behave no differently over the cycle, the t-statistics should approach zero.

## LITERATURE CITED

1. J. H. Wood, Commercial Bank Loan and Investment Behavior, Wiley Monography in Applied Econometrics (London and New York: John Wiley & Sons, 1975).