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Between Banks in the USA**

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Evidence of Rational Risk Aversion on the Part of Smaller Banks

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The interlinkages between banks has been identified as one of the principle justifications for Too Big To Fail policies of banking authorities. This paper investigates the interlinkages present in banks in the USA using the Fed Funds and Repo positions as a proxy for exposures of individual banks. Reinforcing existing research, relatively strong correlations are revealed between size of exposure and size of bank, as well as correlations between exposure and distance from some money centers. Interesting fluctuations in these correlations are found to be consistent with perspective of banks as portfolios. The relationships identified by this study are evidence of fundamental economic phenomena, and provide support for the notion that bank interlinkages have the potential to engender banking crises across international boundaries.

JEL Classification: D2, E5, G2, L1, R1

Introduction

The recent banking crisis has provided strong support for the notion of banks that are Too Big To Fail (TBTF) and the response of Lender of Last Resort (LOLR) as the proper response mechanism in a crisis situation. The principal justification for this policy response is that interlinkages with other banks might result in a cascade of failures should a very large sized bank be allowed to fail. Theoretically the logic of this policy is straightforward (see Friedman and Schwarz (1963) amongst others), as is the natural tendency for banks to wish to grow in size (see Berger, et.al (1999), McFadden (2008)). Past empirical work has discovered that there is an inverse relationship between the size of banks and their willingness to lend short term funds to other banks. Moreover, there is a clear positive relationship between size and willingness to borrow short term funds from other banks (see Lucas et. al. (1977), Maerowitz (1981), Stigum (1982), Allen and Saunders (1986), and McFadden (2008)).

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Interbank exposure is of course a key parameter in the probability of a cascade failure in the banking system. A study which is now appearing dated, estimated average actual interbank exposures of banks in the USA to be at least as high as 15% (Furfine (1999)). However, it may be argued that if all banks are well diversified in their exposures, then the theoretical basis for the Too Big To Fail (TBTF) policy would be impaired. On the other hand, if smaller banks tend to be highly exposed and concentrated in their exposures, a TBTF policy would be much more justifiable. Using regularly reported data as a proxy for exposures, this study provides statistics concerning levels of exposures in relation to the size of banks and the relative degree of granularity present in the market. Additionally, as an indication of the potential for transmission of contagion, it seeks to determine the variability in exposures relative to distance from money centers.

Interbank exposures may take the form of Fed Funds positions, short term Repos (repurchase agreements), correspondent banking accounts, interbank loans and other types of interbank accounts. Many of these exposures are uninsured or only partially insured and in the event of bankruptcy, banks exposed on the asset side may suffer substantial losses, thus creating a vector for transmission of contagion. Data concerning many types of exposures are not easily obtainable; however, this study takes the position that the Fed Funds/Repos positions of banks provided in call reports are in fact a good indication of the degree of interbank exposure.

Interbank exposures may be expected to be heterogeneous across banks for several reasons. Such heterogeneity may be a logical outcome of ‘distance costs’, with banks becoming exposed to an increasing number of other banks as they grow larger (see McFadden (2008) for a full discussion). Essentially such theory resides in the fact that returns on investment alternatives in a closely restricted geographic area are more likely to be highly correlated than potential investments in regions that are more geographically separate. Distance costs constrain banks’ abilities to profitably invest in the less highly correlated but more distant investment alternatives. Thus banks seek to grow larger by implanting themselves into progressively more distant regions in order to reduce the cost imposed by geographic separation. As they do so, their total asset size becomes larger while their diversification opportunities increase, improving their return/risk ratios as well as reducing their proportional exposure to any single investment.

Smaller banks may choose to offset excess risk from their more limited investment alternatives by investing in what are perceived as lower risk assets such as Fed Funds, as well as short term deposits at other, more well diversified larger banks. Logically, therefore, smaller banks should be net suppliers of Fed Funds and short term deposits while larger banks should be net demanders of the same. Geo-spatial economic theory would have small banks are being more likely to be found farther from metropolitan centers (see for example Fujita, et al (2001)). Thus it may be possible to discern a relationship between exposure to interbank lending and distance from banking centers.

The following relationship may therefore be hypothesized:

$$\frac{Fo_i}{TA_i} = \alpha_1 + \beta_1 D + \varepsilon_1 \tag{1}$$

$$\frac{Fp_i}{TA_i} = \alpha_2 + \beta_2 D + \varepsilon_2 \tag{2}$$

- where: TA_i = the size of a bank as measured by its total assets
- Fo_i = funds offered via interbank accounts of a bank
- Fp_i = funds purchased via interbank accounts of a bank

The prior expectation is that the correlation between distance and exposure on the offering side will be positive and negative on the purchasing side.

To fully test the relationships between size and exposure and distance and exposure, it would be necessary to have detailed information concerning individual bank portfolios. Nevertheless, it may be hypothesized that systematically high exposure to Fed Funds and repos (repurchase contracts) on the asset side by small banks coupled with systematically low exposure to similar assets by large banks may provide some support for the theory described above. The existence of such relationships has been demonstrated by earlier empirical studies of the Fed Funds market (as mentioned above), but the present document confirms that such trends are still present in today’s market and, moreover, tests the stability of such relationships.

The Data

This study examines quarterly bank balance sheet data over the period Q1/2000 to Q1/2009. Data is taken from call reports which the Federal Deposit Insurance Corporation (FDIC) collects on all credit institutions that subscribe to deposit insurance in the USA. The information is freely available and is accessible via the internet¹. Quarterly data is available only since the beginning of 2000.

The data made available by the FDIC is extensive, but not without problems in its usage. Notably, the Fed Funds and repos offered and purchased by banks are provided as summary data reported by each reporting bank. There is no detail concerning maturity or counterparty. Fed Funds, which are uninsured and uniquely interbank accounts, are reported together with repos, which are collateralized and include investment banks within their market. It is impossible to disaggregate the reported number in order to determine the level of only Fed Funds.

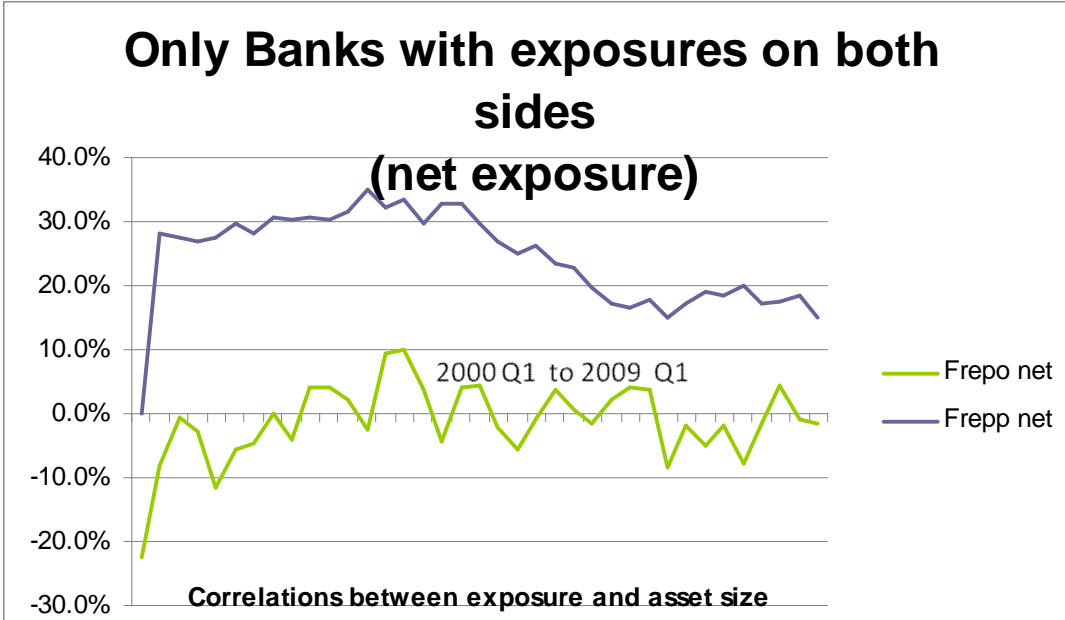
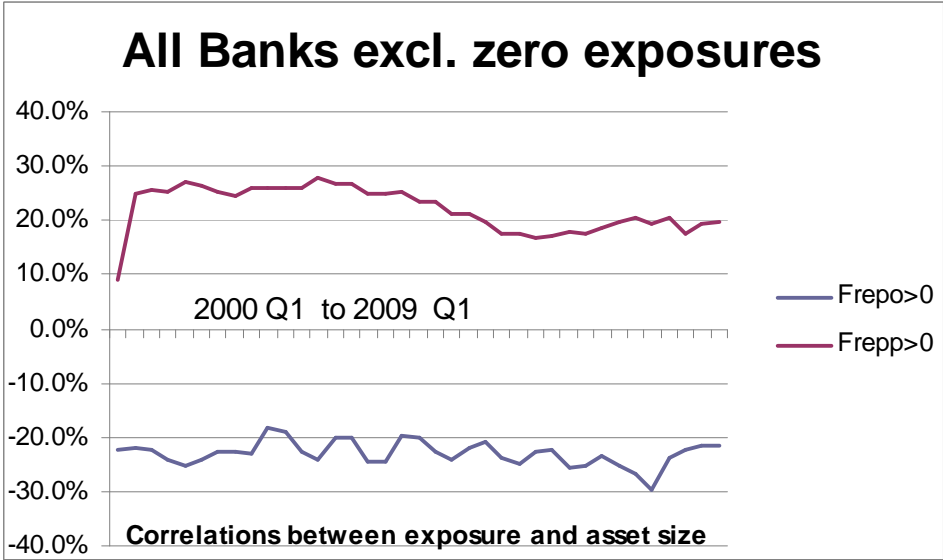
Also, it should be noted that banks with less than \$100 million in total assets are not required to separately report all accounts, nor are thrifts required to separately report interbank activity; and, judging by the substantial number of banks in the sample that reported neither funds offered nor purchased (roughly 14% of all banks in the data set). Missing data has a strong potential for introducing bias into the statistics in the study. This is particularly true where smaller banks lend on a day to day deposit basis to ‘broker’ banks which in turn market the money onto the Fed Funds market. Moreover, there is a strong likelihood that small banks do not report their market positions since they are not required to do so. This would clearly tend to weaken any statistics seeking to describe a relationship between size and exposure, or distance to metropolitan centers and exposure.

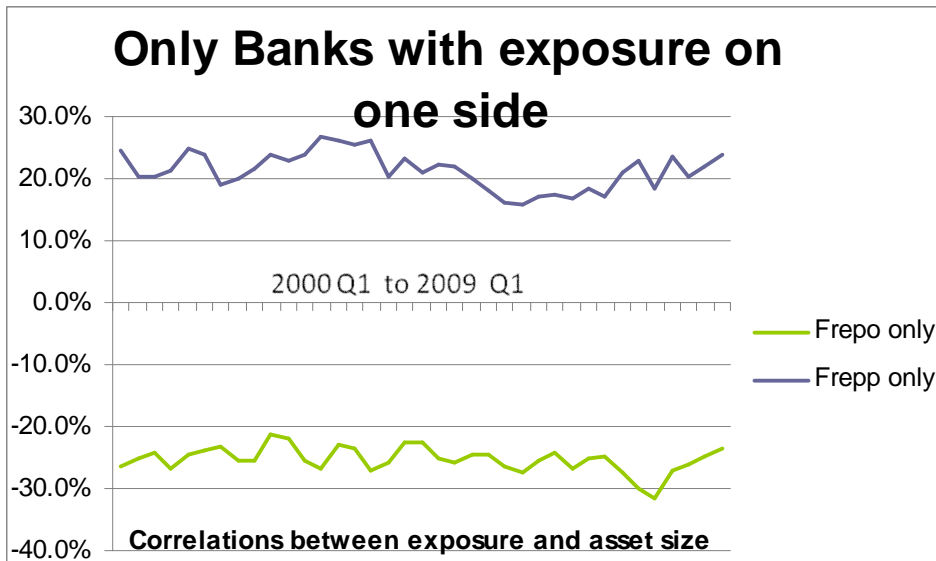
The Relationship between Asset Size and Exposure to Fed Funds & Repos

The relationship between size and exposure varies substantially in any one reporting period depending upon whether or not one includes all banks within the measure or only those reporting an exposure. Moreover, a number of very large banks report simultaneous

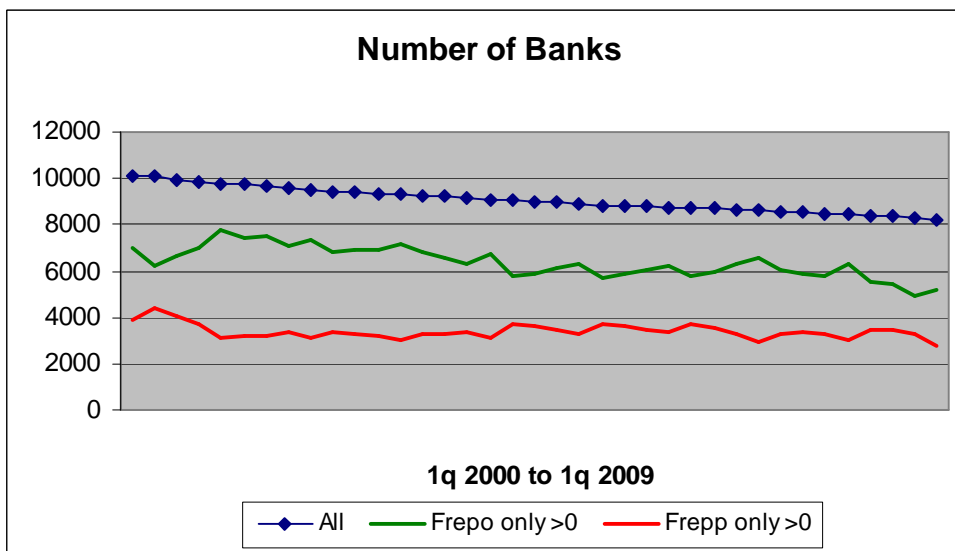
¹ <http://www.fdic.com>

exposures on both sides of the market and correlations will differ depending upon whether one includes such banks on a net exposure basis or simply include their actual exposure on both sides. The following graphs provide a visual image of the evolution in the correlations between the total assets of banks and their exposure to a specific side of the market.

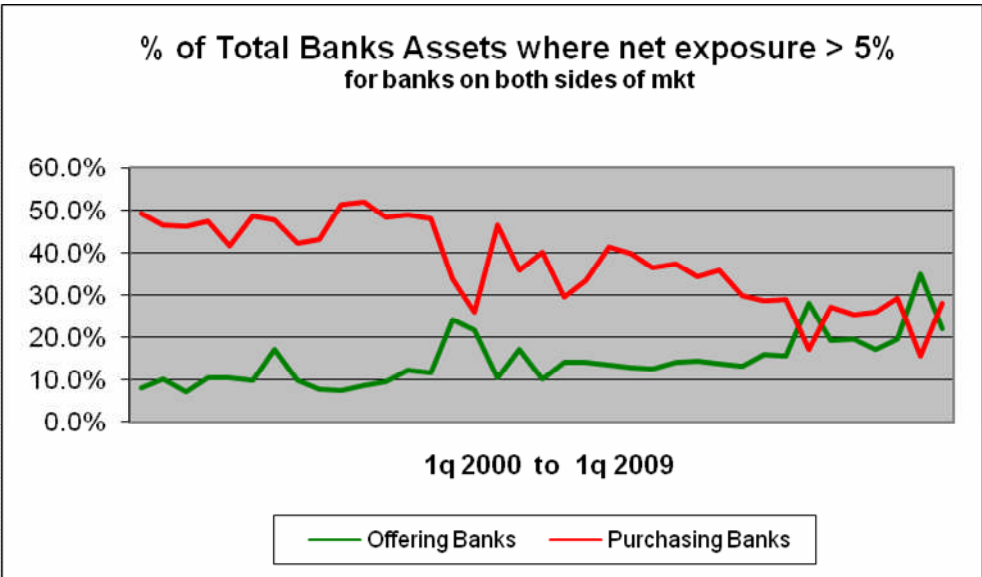
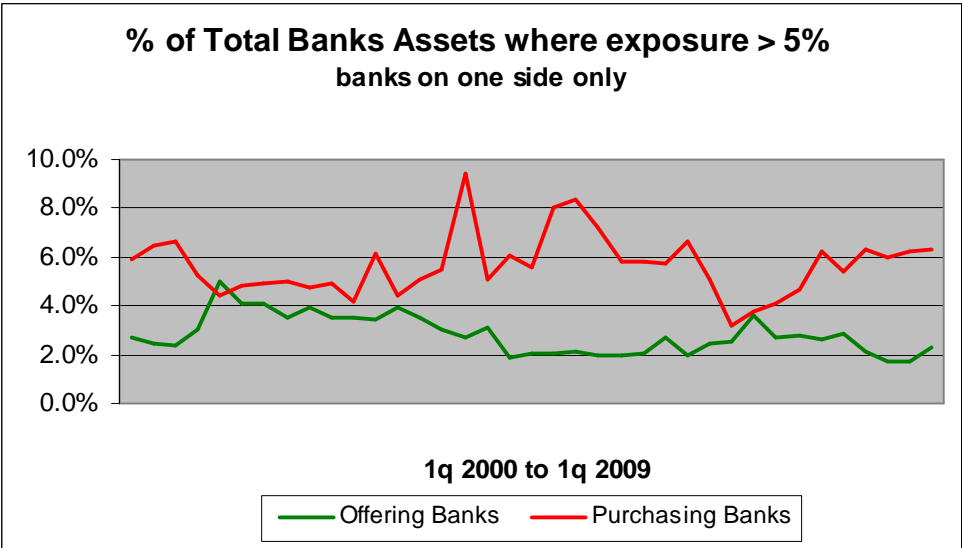
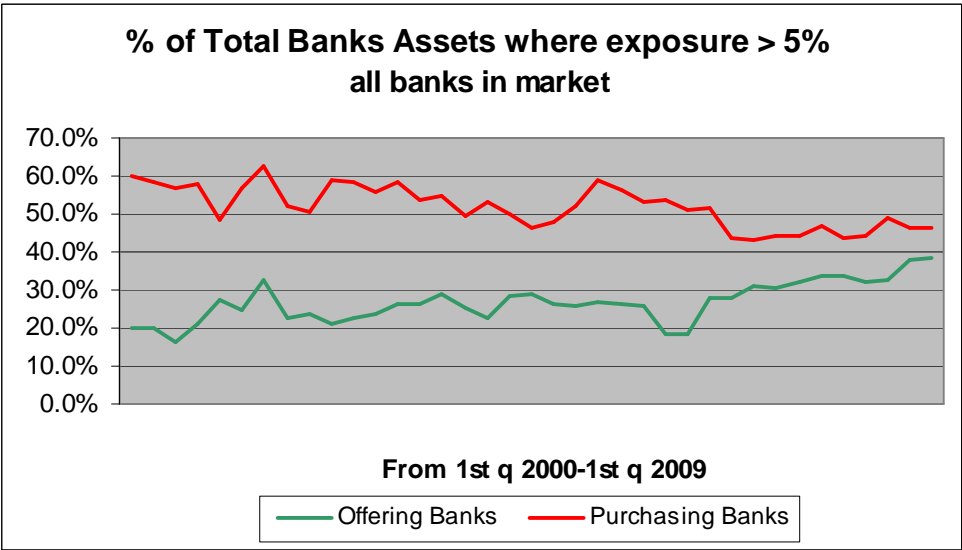




Additional contribution to variation would be the fact that the number of banks offering Fed Funds and the number of banks purchasing Fed Funds in any given year of the survey are substantially different. The following graph provides a pictorial display of the evolution in the numbers of banks on a quarterly basis since the start of the year 2000. Clearly, the ongoing consolidation in the sector has something to do with this source of variance.



Small exposures would be relatively insignificant in systemic terms. What would be worrisome, however, is if a large percentage of bank assets were exposed to this source of risk. The following charts present the percentage of total US bank assets that are characterized by exposures of greater than 5% to this source of risk.



In each of the time periods covered by the survey, the mean value of the total assets of highly exposed Fed Fund offering banks is substantially below that of highly exposed Fed Fund purchasing banks. Moreover, the number of highly exposed offering banks is considerably larger than that of highly exposed purchasing banks. These facts are particularly interesting in light of the relationships between distance from banking centers and exposure established in further statistical testing of the data base.

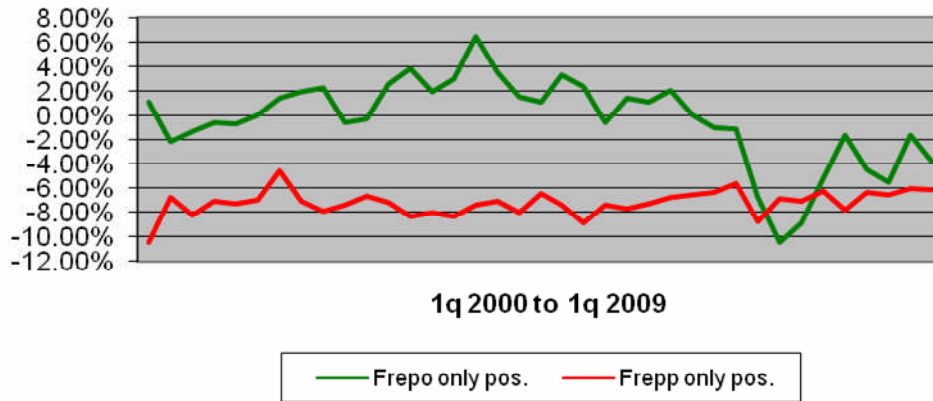
Relationship between Exposure and Distance from Money Centers

The FDIC call report data includes zip codes of bank headquarter locations; thus, it is possible to calculate the geographic distance between the centroid of a bank's zip code region and any other point on the globe. Using the centroid as a proxy for the bank's actual location, distances in kilometers were calculated between each bank in the data set and the geographical center of 15 major metropolitan centers² in the USA.

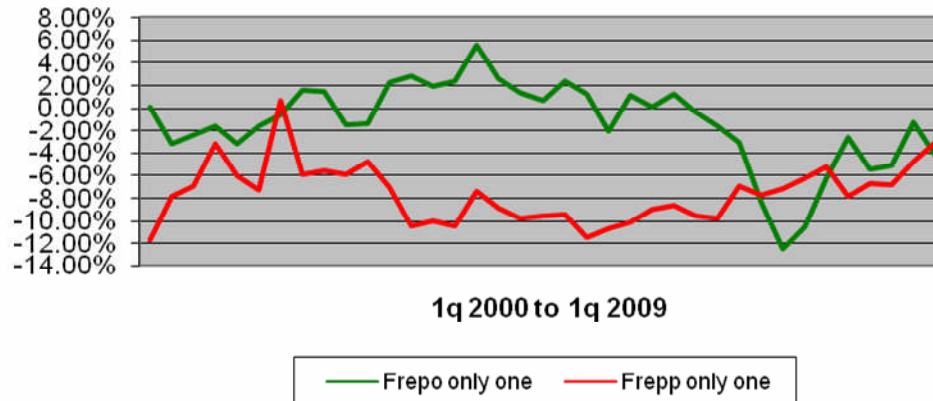
Significant, positive correlations exist between the magnitude of exposure to short term lending of funds and the nearest distances to major metropolitan centers in the USA, i.e., banks with a greater percentage of their assets in the FREPO market tend to be farther from metropolitan areas. The following charts present correlations between exposure to either the FREPO or FREPP of banks (banks reporting no activity in either market were dropped from the data set) and distances to the nearest metropolitan center.

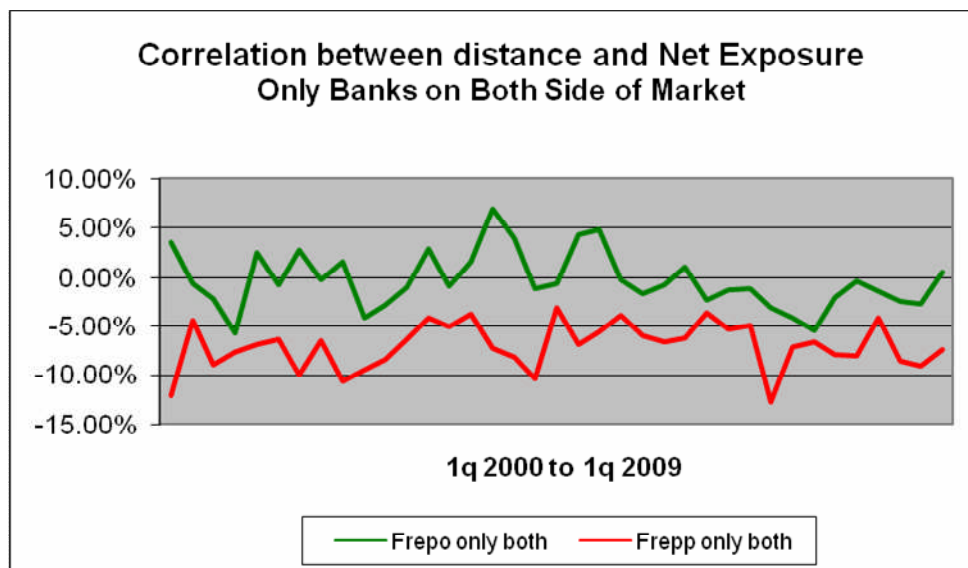
² Seattle, Los Angeles, Houston, Kansas City, St. Louis, Chicago, Cincinnati, Cleveland, Pittsburgh, Jacksonville, Montgomery, Baltimore, Philadelphia, New York City, and Boston.

Correlation between distance and Exposure Only Banks in Market



Correlation between distance and Exposure Only Banks on One Side of Market Only





What is immediately clear from these charts is that there is only a slight correlation between distance from city centers and exposure on the asset side of the market. A possible reason for the weakness of the correlations on the asset side may reside in the fact that small banks are not required to report FREPO or FREPP data and may thus have been excluded from the statistical analysis as ‘missing data’.

The correlations, as measured, are not constant, but vary across the time period studied. Notably, in the years 2000 and in the year 2007 the correlation between distance and exposure to the asset side went negative. It is clear that financial markets in both years were under great tension: in 2000 there was a ‘collapse’ of the so-called internet bubble in the equity markets, and in 2007 the beginning of the current, ongoing, worldwide banking crisis. This change to negative correlation may be seen as a rational risk aversion on the part of banks which normally offer liquid assets. Unfortunately, the paucity of data points and events do not allow for more rigorous econometric treatment of this proposition.

On the liability side of the market, the correlation between distance from money centers and exposure are consistently and substantially negative. This of course can be viewed as strong support for the geo-spatial argument which would have the larger banks located close to or within money centers. As demonstrated earlier in this study, it is indeed the larger banks which are overwhelmingly the purchasers of short term funds.

Summary and Conclusion

The mosaic of the evidence obtained via the empirical examination of the call report data of the FDIC provides evidence that is favorable to the proposition that smaller banks will lend proportionately more to larger banks. It is also favorable to the proposition that banks located farther from money centers will tend to lend proportionately more to other banks. Although the evidence in favor of these relationships is in the form of the proxy of Fed Funds and repos and there is no other data available that clearly establishes the existence of interlinkages between small banks and larger banks. The large banks, as a group, are net purchasers of funds.

The weight of the evidence is therefore in favor of the theory that the highly exposed offering banks are indeed highly exposed to larger banks. The statistics presented in this study buttress this proposition. Moreover, since the number of purchasing banks is substantially less than the number of offering banks, the risk of any purchasing bank failing will most probably affect more than one smaller, highly exposed offering bank.

Again, there is no direct evidence in this data that indicates that highly exposed smaller banks are in fact highly exposed to larger banks, but the probabilities involved and the evidence presented in the statistical runs and the charts strongly support the conclusion that such a relationship exists. This in turn provides support for the proposition that larger banks represent a greater degree of systemic risk to the economy than do smaller banks. There are clear implications in so far as concerns prudential regulation. Additionally, the correlation between distance from money centers and exposure provide some evidence of the existence of a transmission mechanism for contagion via the short term funds market.

Given the stability of the relationships discovered, it may be that the relationships are symptoms of fundamental economic forces such as those discussed in McFadden (2008) which push smaller banks to diversify by lending to large banks (so much the better if these larger banks are Too Big To Fail) and that banks become larger by diversifying geographically. Should such growth entail international diversification, it seems clear that the

bankruptcy of such a bank would certainly create the potential for an international transmission of a banking crisis.

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