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Orange County Bankruptcy: Financial Contagion in the Municipal Bond and Bank Equity Markets

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Abstract

We examine the spillover wealth effects of the Orange County, California bankruptcy announcement in December 1994 on municipal bonds, municipal bond funds, and bank stocks. This bankruptcy is prominent because of unprecedented losses and because it was caused by a highly leveraged derivatives strategy rather than a shortage of tax revenues and excess spending. We find contagion in the bond market with significantly negative abnormal returns for municipal bond funds without direct exposure to Orange County and for non-Orange County municipal bonds. In addition, our findings suggest the contagion spills over to the common stocks of investment and commercial banks that deal in or use derivatives; however, the equities of banks unexposed to derivatives are not affected.

Keywords: municipal financing, contagion, derivatives, fixed income, bank equity

JEL Classifications: G2/H3/K2

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1. Introduction

On December 6, 1994, Orange County, California (hereafter Orange County) became the largest municipality in U.S. history to declare bankruptcy. This bankruptcy is prominent not only because of its unprecedented loss of $1.7 billion, but also because it was caused by a highly leveraged derivatives strategy rather than by fundamental cash flow problems of tax revenue shortages and excess spending. Extant financial contagion models predict that extreme events, like this bankruptcy, can amplify the negative shocks suffered by a particular institution and transmit the crisis to other sectors of the economy (see Allen and Gale, 2000; Kyle and Xiong, 2001). It is important to test this prediction by investigating whether this bankruptcy was a "county-specific" or localized event or whether it caused wealth losses at other institutions not directly exposed to the county. We call the county-specific wealth effects of the bankruptcy the *local effects hypothesis* and the negative wealth effects on unexposed municipalities and banks the *contagion hypothesis*. Testing for contagion helps investors and regulators understand how information effects spread to unrelated markets and geographical regions.

Using event study and cross-sectional regression methods, we find that the Orange County bankruptcy is associated with significant negative abnormal returns. In addition to the expected negative impact on securities directly exposed to Orange County, municipal bond funds not containing Orange County bonds and non-Orange County municipal bonds also suffered losses. We also find that the Orange County bankruptcy announcement negatively impacted the stocks of investment and commercial banks that use and market derivative instruments. However, banks with no exposure to derivatives were not affected. The evidence supports the need for full public disclosure, regulatory oversight over leveraged speculation, and stringent internal controls over derivatives usage by municipalities so that the crisis at one institution does not infect other more prudently run municipalities and banks.

2. Background of the Orange County bankruptcy

Following the fiscal austerity imposed in California through the passage of Proposition 13 in 1978, many municipalities sought creative ways to increase revenues and services without raising taxes. Because the regulation of municipalities' investment funds was far less stringent than that of mutual and other private investment funds, some local governments turned to derivatives-based speculation to raise revenues. Robert Citron, treasurer of Orange County, managed the Orange County Investment Pool (OCIP) using excessive leverage and a risky derivatives strategy (e.g., reverse repurchases) to bet on interest rate fluctuations.[1] Relying on financial advice

[1] At the time of the bankruptcy, the OCIP portfolio consisted of $646 million in cash, $11 billion in fixed income securities, $222 million in collateralized mortgage obligations, $556 million in floating-rate notes, $4.8 billion in inverse floating-rate notes, $1.5 billion in index-amortizing notes, $135 million in dual-index

from Merrill Lynch, he gambled on a stable and upward-sloping term structure in the early 1990s. However, throughout 1994 the Federal Reserve Board announced six increases in the discount rate. Due to his misjudgments, the county lost $1.7 billion and declared bankruptcy on December 6, 1994. After the bankruptcy was declared, Orange County defaulted on a $110 million pension bond and investors feared additional defaults. The bankruptcy was further complicated by the fact that so many municipalities had money invested in the OCIP (Baldassare, 1998).

The bankruptcy announcement by a large California county was unprecedented and caught the financial community by surprise. In addition, the lack of transparency in reporting municipal derivatives holdings had covered up the degree of losses suffered by the OCIP prior to the announcement. Current literature on financial contagion suggests that economic shocks of this magnitude could potentially spread to other local governments not directly exposed to the original shocks for both fundamental (rational) and irrational reasons (Kyle and Xiong, 2001; Ross, 2001). Thus, the announcement provides a good opportunity to analyze contagion and the capital market dynamics of an unexpected crisis in public finance.

3. Related literature

It is important to distinguish between two basic types of capital market responses to the Orange County crisis: direct and indirect wealth effects. Direct wealth effects are those on bonds issued by the Orange County; thus, they result from direct exposure to Orange County. If the market views the financial distress as an isolated county-specific idiosyncratic event then only the securities issued by Orange County should suffer a loss at the bankruptcy announcement. Under this view, the plight of Orange County should have little effect on the market prices of bonds and stocks of other institutions. We term this view the *local effects hypothesis*.

More importantly, recent studies on financial contagion point out that economic shocks at one or a few institutions or a particular economic region can be transmitted to other institutions or regions. They represent indirect wealth effects based on contagion and competition. We call the negative wealth effects suffered by institutions

notes, and $13 billion in reverse repurchase agreements. The average duration of the securities in the OCIP was 2.3 years. However, most large sums of money that were owed through the reverse repurchase agreements had to be paid back in 180 days, or 6 months. Also, some of the 194 public agencies invested in the fund were interested in withdrawing their funds before 2.3 years. Citron was not prepared for a run on the money by pool participants. After the bankruptcy, the California state auditor calculated the risk level in the OCIP. The auditor used a "duration score," which measures the susceptibility of a fund's principal to interest rate increases. Between 1991 and 1994, the risk level in the OCIP increased substantially from a score of 2.7 to 7.4 as the fund increased in size and became involved in a more aggressive investment strategy. By comparison, a passbook savings account receives a duration score of 0 because its principal is not influenced by higher interest rates. The usual money-market funds for local governments, which seek to obtain investment returns with short-term securities, have a score of 1.8. High-yield or "junk" bond funds typically have a score of 4.5 (Jorion, 1995; Baldassare, 1998).

unexposed to the original economic shock the *contagion hypothesis*. Current theoretical literature presents several propagation mechanisms for financial contagion. Some view contagion as an irrational phenomenon, whereas others model it as a rational equilibrium phenomenon. The irrational approach assumes that, unlike small negative returns, extreme (left tail) events induce investors to ignore economic fundamentals, leading to excess volatility and even panic. In contrast, rational models focus on different channels of propagation of shocks. In incomplete information models, fundamental risks are correlated across assets, but uninformed investors cannot distinguish between price declines due to liquidity shocks and those from shocks to fundamentals. When rational noise traders observe a decline in the price of one asset, they take it as a signal predicting a fall in the price of all assets. Thus, a financial distress at one institution can create a self-fulfilling expectation of a crisis at other firms. A classic example of this approach is the model of bank runs by Diamond and Dybvig (1983), in which depositors do not have information to distinguish between bank-specific events and market-wide developments. When random liquidity shocks induce some depositors to withdraw funds, other depositors make a run on the bank, even though no fundamental change in the economic prospects of the bank has occurred (also see King and Wadhwani, 1990; Calvo, 1999).

Allen and Gale (2000) analyzed overlapping claims that different financial institutions have on one another as an alternative channel for financial contagion. In their model of an incomplete interbank market for deposits, financial institutions hold a poorly diversified portfolio of deposit claims because of transaction and information costs. When one institution suffers an adverse shock, others suffer a loss because the value of claims on the distressed firm falls and they are forced to prematurely liquidate their long-term investments. Kyle and Xiong (2001) described financial contagion as a wealth effect. In their model, speculative traders take large levered positions to profit from temporary discrepancies between market prices of assets and their fundamental values due to significant deviations of noise trading from its mean. When they suffer trading losses due to shocks, their increased risk aversion motivates them to liquidate long-term investments, resulting in contagion. Thus, the (endogenous risk of) portfolio rebalancing of speculative traders amplifies the fundamental economic shocks. In Rochet and Tirole (1996), the crisis at one bank leads the investors to assume that other banks are not properly monitored and can suffer in a similar manner, thus resulting in contagion.

Finally, Lang and Stulz (1992) pointed out that in highly concentrated industries positive competitive effects can counter negative contagion effects of financial distress suffered by a firm. Crisis at one firm can result in increased demand for competitors' products because of customers' uncertainty about conducting business with the distressed/bankrupt company. Also, the bankrupt company could face greater marginal costs and thus higher prices and lower output. This could provide competitors an opportunity to benefit by increasing their prices. Further, the bankruptcy announcement could enable competing firms to prey on the weakened bankrupt company. Hence, under a competitive effect, other companies in the industry can have valuation reactions opposite to those of the bankrupt company. Lang and Stulz found that the contagion effect outweighs the competitive effect.

Denison (2000) is the only available published study of the market response to the crisis at Orange County. This study focused on the direct effects of the bankruptcy announcement and examined the informational efficiency of the municipal bond market. Based on a sample of 92 load and no-load bond mutual funds that invest in California municipal securities, it concluded the municipal bond market responded immediately to the bankruptcy. However, this study does not investigate the indirect effects (i.e., the contagion hypothesis) of the Orange County crisis—the wealth effects on non-Orange County securities.

Numerous other empirical studies have analyzed contagion and competitive effects in the stock market with mixed results. Representative among them are Aharony and Swary (1983), Karafiath and Glascock (1989), and Dickinson, Peterson and Christiansen (1991), who all find little evidence of contagion following bank failures. On the other hand, Swary (1986) analyzed the financial difficulties at Continental Illinois and found support for contagion. Lang and Stulz (1992) found evidence in support of both contagion and competitive intraindustry effects associated with corporate bankruptcy announcements. Avila and Eastman (1995) studied the impact of information releases and failure of a small sample of large insurance firms and report evidence of contagion. Laux, Starks, and Yoon (1998) found that the contagion and competitive effects due to dividend announcements are not mutually exclusive. For the same event, the contagion effect can dominate for some companies whereas the competitive effect dominates for other companies. Sinkey and Carter (1999) examined the reaction of bank stock prices to news of derivatives-related losses suffered by corporate clients of Bankers Trust. They reported significant negative abnormal returns for all banks in their sample except for those which do not use derivatives. Overall, the available empirical evidence on the contagious effects of economic shocks is mixed.

4. Hypotheses

We analyze the local effect hypothesis and the contagion hypothesis by investigating the differential impact of the Orange County bankruptcy on samples of bonds, bond funds, and bank stocks both with and without exposure to Orange County. The local effects hypothesis indicates that the non-Orange County bankruptcy announcement will negatively affect bonds and bond funds associated with Orange County but have no impact on securities that are not associated with Orange County. The contagion hypothesis indicates that securities that are not associated with Orange County will be negatively impacted by the bankruptcy announcement.

If investors thought the Orange County bankruptcy was an isolated "county-specific" event rather than a contagion, then we should find, as did Denison (2000), negative abnormal returns to be associated with Orange County municipal bonds (as predicted by the local effects hypothesis). However, the local effects hypothesis also assumes that the impact will not spill over into other unrelated securities. Under the contagion hypothesis, negative abnormal returns will also be associated with securities not associated with the Orange County bankruptcy. We expect the bankruptcy announcement to lead to contagion-type negative wealth effects for institutions and instruments that are not directly exposed to Orange County for several reasons. First, the reporting process at that time allowed municipalities to hide leverage-intensive derivatives-related losses, thus denying public access to credible information on municipal derivatives holdings. Because of the lack of transparency, investors could have sold off both healthy and financially troubled non-Orange County securities, analogous to the transmission of contagion in bank runs discussed by Diamond and Dybvig (1983). Second, consistent with the model of interinstitutional cross-holdings of liabilities offered by Allen and Gale (2000), defaults by Orange County municipalities can lead to premature liquidation of long-term investments by their creditors (municipal bond investors and banks). Finally, contagion can follow the wealth amplification effects modeled by Kyle and Xiong (2001) where a troubled institution must liquidate some of its positions. Speculators with similar trading strategies and positions could simultaneously dump their security holdings in the distressed firm. Moreover, trading losses could reduce their capacity to bear risks and could motivate them to sell off other assets in their portfolios.

It is possible that, as a result of the competitive effect, other municipalities can even benefit from Orange County's difficulties. Anticipating adverse effects on Orange County municipalities' ability to service their debt obligations, investors in the municipal bond market can switch from the troubled bonds to unexposed bonds. Such a competitive effect can lead to positive abnormal returns on bonds issued by non-Orange County municipalities. Consistent with Lang and Stulz (1992), we believe that the contagion effect will dominate the potential competitive effect. Thus, we expect the Orange County's bankruptcy announcement to be associated with a negative market reaction for non-Orange County municipal bonds and municipal bond funds with no exposure to Orange County.

Because the Orange County bankruptcy is a highly leveraged derivatives-driven crisis, the contagion could spill over to other users and suppliers of derivative products.[2] Key participants in the derivatives market are banks, both as end-users and as dealers. As end-users, they can either use derivatives to hedge their own risk exposures or speculate on price movements. As dealers/brokers, banks provide over-the-counter derivative products to other banks, corporate clients, or municipalities. Although all user banks participate in derivatives as end-users, only the largest institutions are dealers of derivatives. The Orange County bankruptcy announcement can have adverse consequences for dealer banks resulting from an increased probability of costly

[2] In 1994, several corporate clients of Bankers Trust (a derivatives dealer), including Proctors Gamble and Dell Computer, suffered significant derivative-related losses. Sinkey and Carter (1999) found that besides negatively impacting Bankers Trust, other derivatives dealer banks suffered significantly negative stock price reactions at these announcements.

litigation related to product liability, *ex post* settling up expenses, regulatory penalties, default by disgruntled customers, and reduced demand for derivative products.[3] In addition, the bankruptcy can infect the stock prices of nondealer user banks due to investors' fears that these banks also have used money-losing trading strategies similar to those of Orange County. Therefore, we expect the Orange County's bankruptcy announcement to lead to negative abnormal returns for stocks of user and dealer banks and the effect to be greater for dealer banks.

5. Data

Our primary objective is to test the contagion hypothesis of the Orange County bankruptcy—that the crisis would adversely affect the bond prices of non-Orange County municipalities, bond fund prices not directly exposed to the Orange County, and stock prices of banks that deal or use derivatives. Because December 7, 1994, is the first day that investors could react to Orange County's bankruptcy announcement, we focus on the capital markets response to the event on that day. To extend the market efficiency study of Denison (2000) beyond a sample of California bond mutual funds, we identify a sample of 65 traded municipal bond mutual funds, including 15 funds that contain bonds issued by Orange County local governments and 50 funds with no exposure to Orange County. Daily closing net asset values (NAV) and dividends (if applicable) for each municipal bond fund are collected from Bloomberg, from 130 trading days before to 8 trading days after the bankruptcy announcement. For each fund, its bond's geographic location (municipality and state), maturity, default rating, status as an insured entity, and net assets under management are taken from the fund's 1994 annual report.

The advantage in using the bond mutual fund data is that the fund prices are traded prices (as contrasted with the estimated matrix prices) at which fund investors buy and sell shares. However, NAVs reflect the degree of diversification chosen by the funds, their cash holdings, management fees and sales, and redemption loads. Thus, the price effects based on the fund data provide noisy estimates of the wealth effects due to the Orange County crisis. To scrutinize the robustness of our analysis based on fund prices and shed further light on the contagion hypothesis, we also identify 352 municipal bonds from Bloomberg Financial Markets in the following geographic locations: Orange County, and California, but not Orange County, and 20 randomly selected municipalities from seven geographically diverse states (Arizona, Connecticut, Florida, Illinois, Michigan, New York, and Texas). Bond prices on the Bloomberg are algorithmically determined matrix prices rather than dealer quotes or transaction prices (which are not available). Nunn, Hill, and Schneeweis (1986) found that matrix bond prices are more reliable than exchanged-traded bond prices

[3] On January 12, 1995, Orange County filed a $2.4 billion lawsuit against Merrill Lynch, charging the brokerage house with selling the county highly risky securities in violation of state and federal laws.

because the former reflect the round-lot trades of institutional investors whereas the latter reflect the negligible, odd-lot trades of individual investors. Warga and Welch (1993) noted that although matrix prices are adequate under normal circumstances, they are not completely satisfactory for use in event studies because these prices adjust slowly to firm-specific events. However, our inquiries with a leading investment firm indicated that dealer trade prices for municipal bonds are not available for the relevant period because of litigation concerns surrounding the bankruptcy. Hence matrix prices constitute the best available data. None of the bonds in our sample experience a rating change during the estimation period and event window, and bonds with incomplete or other confounding information are excluded. Our final sample consists of 276 municipal bonds, including 36 bonds from Orange County and 240 bonds outside of Orange County. Each bond's geographic location (municipality and state), coupon rate, maturity, default rating, status as a general obligation, availability of default insurance, sinking fund, and issue size at the time of the announcement are obtained from Bloomberg. The municipality's year-end 1990 aggregate tax base is obtained from the *County and City Data Book* (1994). Daily closing prices for each municipal bond and the Lipper municipal bond index are obtained from Bloomberg for 130 trading days before to 8 trading days after the bankruptcy announcement.

We obtain a list of 13 dealer banks and 31 user banks from the International Swaps and Derivatives Association. Dealer banks sell derivatives, whereas the user banks do not deal but simply use derivatives. In addition, using a keyword search in Bloomberg to exclude banks associated with "derivatives usage," we locate 2,806 public U.S. commercial banks (excluding money center and super-regional banks) that do not use derivatives.[4] Using a random number generating function, we reduce the nonderivative sample to 75 banks. We exclude Merrill Lynch from the sample because of its direct involvement with Orange County derivatives. Similarly, we discard banks with confounding information such as merger and acquisition, earnings surprises, and unexpected dividend increases. Our final sample contains 91 banks, including 11 dealer banks, 29 user banks, and 51 nonderivatives banks. Daily stock returns for the bank subsample are obtained from the Center for Research in Securities Prices (CRSP) database from 130 trading days before to 8 trading days after the bankruptcy announcement. Daily closing prices for the Standard & Poor's (S&P) 500 Index are obtained from Bloomberg for the same time period. Data on each bank's long-term debt, shareholders' equity, and total assets for March 31, 1994, are collected from the Compact Disclosure Database or from the S&P's Stock Reports. Data on each bank's replacement cost (market value) of derivatives for March 31, 1994, are drawn from the Federal Reserve Bank of Chicago.

[4] To the extent our search procedure fails to uncover banks that in fact use derivatives, our sample of nonderivative banks could include some institutions that use derivatives but do not report them. However, the insignificant intercept estimate reported in Table 4 for the banks regression suggests that this sample selection procedure is adequate.

Table 1

Descriptive statistics for municipal bond, bond mutual fund, and bank samples

Data for the bond funds sample of 15 funds with Orange County exposure and 50 funds with no Orange County exposure are obtained from the funds' 1994 annual report. Data for the 36 Orange County and 240 non-Orange County municipal bonds are obtained from Bloomberg as of December 6, 1994. The 1990 year-end data for the municipality's aggregate tax base are obtained from the *County and City Data Book* (1994). The remaining data are obtained from Bloomberg as of December 6, 1994. Data for bank sample include 11 derivative dealer banks (dealer), 29 nonderivative dealer user banks (user), and 51 nonderivative user banks (none). Each bank's long-term debt, shareholders' equity, and total assets for March 31, 1994, are obtained from the Compact Disclosure Database or from the Standard & Poor's Stock Reports. Each bank's market value replacement cost of derivatives for March 31, 1994, is obtained from the Federal Reserve Bank of Chicago. The leverage ratio is calculated as long-term debt divided by the summation of long-term debt and common equity. Range refers to the difference between the maximum and minimum values.

Panel A: Municipal bond funds

	Mean		Median		Range	
	Orange County	Non-Orange County	Orange County	Non-Orange County	Orange County	Non-Orange County
Avg. maturity of bonds (years)	14	19	15	19	22	16
Net assets (millions $)	1,347	344	1,114	194	4,965	1,656
Percent of bonds rated A or higher	87	80	100	81	76	50

Panel B: Municipal bonds

	Mean		Median		Range	
	Orange County	Non-Orange County	Orange County	Non-Orange County	Orange County	Non-Orange County
Coupon rate (%)	4.58	5.98	5.40	6.00	9.10	8.63
Municipality's aggregate tax base ($ millions)	66	435	56	174	89	1,589
Maturity (years)	16	13	17	12	24	28
Issue size ($ millions)	76	95	71	61	143	418

Panel C: Banks

	Mean			Median			Range		
	Dealer	User	None	Dealer	User	None	Dealer	User	None
Total assets ($ billion)	110.5	29.8	1.3	103.7	26.5	0.9	204.4	76.2	4.4
Replacement cost of derivatives-to-total assets (%)	8.5	0.4	0.0	7.3	0.2	0.0	22.2	3.0	0.0
Leverage ratio (%)	45.5	29.4	6.0	45.0	26.4	0.8	38.1	61.2	23.6

Table 1 reports descriptive statistics useful in understanding the difference in wealth effects between the exposed and unexposed securities. Panel A demonstrates that bond funds with Orange County exposure have on average shorter maturities, much larger net assets, and hold a greater percentage of high-quality (rated as investment grade) bonds than those with no Orange County exposure. In addition to the data reported in the table, insured bonds account for 38% and 73%, respectively, of NAV of funds with and without exposure to Orange County. Panel B indicates that the Orange County bonds are smaller in issue size, carry lower coupons, and longer maturities on average than the non-Orange County bonds. The median aggregate tax base of municipalities issuing Orange County bonds is roughly 15% of the size of bonds issued outside of Orange County. Although the data are not reported in Table 1, non-Orange County bonds are more risky than Orange county bonds. A higher percentage of the Orange County bonds are insured (87% vs. 54% for non-Orange County bonds). A larger percentage of the Orange County bonds are rated investment grade (97% vs. 89% for non-Orange County bonds). None of the Orange County bonds but 71% of the non-Orange County bonds are general obligation bonds. Both groups carry similar sinking fund provisions.

Panel C reports the descriptive statistics for our sample of banks. The mean total assets for the dealer banks is almost four times larger than for the user banks. The nonderivatives banks have the smallest mean total assets, less than 5% of user banks. Similarly, the mean replacement cost of derivatives-to-total assets for the dealer banks is much larger than for the user banks (8.5% vs. 0.4%, respectively). The mean leverage ratio (the ratio of long-term debt to the sum of long-term debt and common equity) for the dealer banks is almost twice as large as that for user banks. The nonderivatives banks have the smallest mean leverage ratio.

6. Empirical evidence on wealth effects

6.1. Event study methods

We use the event study method to analyze the wealth effects of Orange County's bankruptcy announcement on our sample of municipal bond funds, municipal bonds, and bank stocks. We estimate abnormal returns for individual municipal bond funds and municipal bonds using the mean-adjusted return methodology as modified for bonds by Handjinicolaou and Kalay (1984) and Datta and Dhillon (1993). For each security, a geometric mean of daily bond returns (defined as price change plus accrued interest based on the convention of "actual/actual" day count) is computed over a 100-day comparison period (pre-event estimation period) ending 31 trading days prior to December 7, 1994, the day following bankruptcy announcement (event day $t = 0$).[5] The abnormal return is calculated as the difference between

[5] Following Handjinicolaou and Kalay (1984) and Klein and Tirtiroglu (1997), we use a pre-event window period to estimate the comparison period to avoid contamination from using a post-event window period. Datta, Iskandar-Datta, and Patel (1997) used a post-event window period to estimate their comparison period because they studied bond initial public offerings for which a pre-event window period does not exist.

the daily return surrounding the event and the comparison period geometric mean return.[6]

We estimate abnormal returns for stocks of banks that deal in derivatives (called *dealer banks*), banks that only use derivatives (*user banks*), and banks with no involvement in derivatives (*non-derivative banks*) using the market model methodology of Brown and Warner (1985) as modified by Johnson, Pari, and Rosenthal (1989). As with the bond returns we use a 100-day comparison period (pre-event estimation period) ending 31 trading days prior to the bankruptcy announcement but using the S&P 500 Index as the market proxy. Consistent with recent bank event studies by Kracaw and Zenner (1996) and Slovin, Sushka, and Polonchek (1999), we use a single-factor equity market index rather than an extra interest rate factor. As noted in Giliberto (1985), this avoids misspecification problems found in the two-factor model used by Flannery and James (1984). To take into consideration possible cross-correlated abnormal returns, we construct a portfolio test statistic following Jaffe (1974), Brown and Warner (1985),[7] and O'Hara and Shaw (1990).[8]

6.2. Event study results

Table 2 presents the abnormal return estimates surrounding the Orange County bankruptcy announcement. The bond fund and bond samples are partitioned into two groups, exposed and unexposed securities. The bank sample is partitioned by type of derivative use.

From Panel A, bond funds holding Orange County bonds earn negative mean abnormal returns of 1.22% on event day 0, which is significant at the 0.01 level. It is consistent with the local effects hypothesis that bonds directly exposed to the bankruptcy will be adversely affected. These results based on the mean-adjusted abnormal returns confirm the findings of Denison (2000) derived from the market model abnormal returns. More importantly, the funds not exposed to Orange County also suffer a negative average abnormal return of 0.91%, significant at the 0.01 level. As expected, the exposed bond funds suffer greater losses. These bond fund results

[6] We conducted additional robustness tests by estimating the wealth effect for municipal bonds using the standard market model following Brown and Warner (1985; discussed more fully in the event study results section), the Cook and Easterwood (1994) market-adjusted return methodology based on the three Lipper municipal bond market indices and the standardized-residual methodology of Patell (1976), and the nonparametric rank test proposed by Corrado (1989).

[7] MacKinlay (1997) observed the seemingly unrelated regression (SUR) alternative to the Brown and Warner technique has several disadvantages relative to this portfolio test. Specifically, under the SUR technique, the test statistic frequently has poor finite sample properties and usually the test has little power against economically reasonable alternatives.

[8] To check on the robustness of our results, we also calculated the traditional Patell (1976) test statistic, and the Boehmer, Musumeci, and Poulsen (1991) test statistic, which focuses on a possible event-induced increase in variance. These tests produced results qualitatively similar to those reported in Panel C of Table 2.

Table 2

Abnormal returns surrounding the December 6, 1994, Orange County bankruptcy announcement

The municipal bond funds and municipal bonds abnormal returns are calculated using the mean-adjusted returns method. The mean bank abnormal returns were calculated using the market model methodology with the Standard & Poor's 500 as a market proxy. Both models' mean abnormal returns (AR) are presented in percents and are based on a parameter estimation period from 130 to 31 days prior to the announcement. The test statistic presented is the portfolio test statistic that adjusts for possible cross-correlated ARs. AR represents the mean abnormal return. N indicates the sample size. The AR < 0 column indicates the percent of the sample with negative AR.

Panel A: Municipal bond funds

	Exposed to Orange County ($N = 15$)			Not exposed to Orange County ($N = 50$)		
Event day	% AR	Test-statistic	AR < 0 (%)	% AR	Test-statistic	AR < 0 (%)
−3	0.61	2.24*	13.3	0.88	3.42***	0.0
−2	0.22	0.94	0.0	0.30	1.18	0.0
−1	0.62	2.69**	0.0	0.72	2.83**	0.0
0	−1.22	−5.28***	100.0	−0.91	−3.47***	86.0
1	−0.18	−0.68	66.7	−0.14	−0.66	56.0
2	0.27	0.99	13.3	0.22	0.87	0.0
3	−0.12	−0.63	100.0	−0.10	−0.40	94.0
0 to +1	−1.40	−4.21***		−1.05	−2.92***	

Panel B: Municipal bonds

	Orange County bonds (N = 36)			Non-Orange County bonds ($N = 240$)		
Event day	% AR	Test-statistic	AR < 0 (%)	% AR	Test-statistic	AR < 0 (%)
−3	0.49	0.72	8.3	0.31	0.73	11.5
−2	0.07	0.21	0.0	0.11	0.45	1.6
−1	0.45	1.34	13.9	0.47	1.97*	2.5
0	−1.07	−3.45***	100.0	−1.15	−4.86***	99.6
1	−0.03	−0.09	27.8	−0.14	−0.56	73.8
2	0.51	1.57	0.0	0.40	1.67	0.0
3	−0.00	−0.02	27.8	−0.06	−0.24	68.4
0 to +1	−1.10	−2.51***		−1.29	−3.38***	

Panel C: Banks

	Dealer banks ($N = 11$)			User banks ($N = 29$)			Nonderivatives Banks ($N = 51$)		
Event day	% AR	Test-statistic	AR < 0 (%)	% AR	Test-statistic	AR < 0 (%)	% AR	Test-statistic	AR < 0 (%)
−3	−0.09	−0.17	54.6	−0.53	−1.58	75.9	0.02	−0.53	51.0
−2	0.71	1.37	36.4	0.07	0.21	31.0	0.86	0.97	25.5
−1	0.30	0.58	36.4	0.42	1.24	31.0	0.59	0.03	39.2
0	0.04	0.08	45.5	−0.01	−0.03	44.8	0.08	0.17	49.0
1	−1.14	−2.23**	81.8	−0.69	−2.05**	72.4	−0.55	−0.08	52.9
2	0.50	0.98	36.4	−0.39	−1.15	62.1	−0.21	−0.83	62.8
3	−0.07	−0.13	63.6	−0.10	−0.30	44.8	0.48	0.18	39.2
0 to +1	−1.10	−1.51		−0.70	−1.46		−0.47	0.47	

*** Indicates significance at the 0.01 level.
** Indicates significance at the 0.05 level.
* Indicates significance at the 0.10 level.

suggest that the negative impact is not limited to bonds and bond funds directly associated with Orange County, but that the bankruptcy announcement results in wide spread contagion.

From Panel B, both of the Orange County and non-Orange County bond samples have significantly negative mean abnormal returns at the bankruptcy announcement. These findings are consistent with the bond fund results and support the contagion hypotheses. The greater negative abnormal return of the nonexposed bonds (1.15% vs. 1.07% for Orange County bonds) is initially surprising, but can be driven by the higher risks for the non-Orange County bonds because none of the Orange County bonds are general obligation bonds and over 85% of them are insured. In contrast, about 70% of the non-Orange County bonds are general obligation and only 46% are insured.

The abnormal return estimates for the unexposed sample of bond mutual funds and individual bonds suggest that the Orange County bankruptcy announcement heightened concerns about the financial health of these municipalities even if they were not directly involved in the bankruptcy. These results indicate that the impact extends beyond local bonds and are consistent with the contagion hypothesis. The results demonstrate that the contagion effect dominates any positive competitive effect that could have resulted from increased demand for both bonds and bond funds that are not linked directly to the bankruptcy.

The Orange County bankruptcy is triggered by a derivatives strategy that backfired and investment and commercial banks are dominant players in the market for derivatives. From Panel C, it is quite surprising that significant negative mean abnormal returns of 1.14% and 0.69% for the dealer and user banks, respectively, did not occur until day 1. However, this is the date that the *Wall Street Journal* reported that Merrill Lynch sold most of the derivative products to Orange County fund and that they could be liable for the fund's massive losses and Merrill Lynch's stock experienced significant abnormal returns of −1.95% on that day. The delayed stock market reaction for unexposed banks suggests that it took until day 1 for investors to sort out the (indirect) exposure of these banks to failed derivatives strategies and product liability. The larger mean negative abnormal returns of 1.14% suffered by dealer banks relative to the mean loss of 0.69% for user banks is consistent with the greater derivatives exposure of the former group. Finally, the average abnormal returns for banks that neither deal in nor use derivatives are not significantly different from zero.[9]

The abnormal returns for municipal bonds reported in Panels A and B are based on the mean-adjusted return methodology and, as such, do not fully account for interest rate sensitivity (i.e., duration effects) of these bonds and funds. To check the robustness of these results, we also estimated abnormal returns by applying Johnson, Pari, and

[9] In unreported results based on Patell (1976) and Boehmer, Musumeci, and Poulsen (1991) test statistics, we find significant (at the 10% level) positive abnormal returns for dealer and user banks for the two days preceding the event day. These results are consistent with a potential competitive effect, which occurs if investors moved funds from Merrill Lynch to its peers.

Rosenthal's (1989) modified version of the Brown and Warner (1985) ordinary least squares method based on a pre-event parameter estimation with the market represented as follows:

$$R_{it} = \alpha_i + \beta_i R_{intt} + \varepsilon_{it} \tag{1}$$

where R_{it} is the return on bond i for day t; as defined earlier, β_i is bond i's beta coefficient, α_i is the ordinary least square's intercept, and ε_{it} is a random error term which is assumed to have a zero mean and be independent and identically distributed over time. The regressor variable R_{intt} is the contemporaneous return on one of three bond market indexes depending on the bond's maturity: (a) the return on the Lipper Short-Term Municipal Bond Index if the bond's maturity is less than 5 years, (b) the return on the Lipper Intermediate-Term Municipal Bond Index if the bond's maturity is between five and 10 years, and (c) the return on the Lipper General Municipal Bond Index, a long-term bond index, if the bond's maturity is greater than 10 years. The beta coefficient captures the impact of term structure and interest rate changes. The use of a municipal bond index, rather than a Treasury bond index, does away with the need to model each bond's normal default risk premium. The daily abnormal return for bond i for event day t, AR_{it}, is calculated as:

$$AR_{it} = R_{it} - (a_i + b_i R_{intt}) \tag{2}$$

where a_i and b_i are the estimated intercept (α_i) and slope (β_i) coefficients, respectively. The revised mean negative abnormal returns for the sample of 36 Orange County bonds and 240 non-Orange County bonds are 0.64% and 0.80%, respectively. The revised mean negative abnormal returns for the sample of 15 Orange County and 50 non-Orange County bond funds are 0.83% and 0.43%, respectively. Based on the standardized-residual tests of Patell (1976), and Boehmer, Musumeci, and Poulsen (1991) the negative reactions are highly significant (at the 1% level). All bonds and bond funds in the Orange County samples, all but one bond in the non-Orange County sample, and 7 bond funds in the non-Orange county sample experience negative returns.[10]

Overall, our findings of significant losses for the unexposed bond funds and bonds at the bankruptcy announcement support contagion in the bond market. Further, the significant negative abnormal returns suffered by the dealer and user banks suggest that the contagion spread beyond the bond market to the bank equity market but with a day's lag. Finally, the evidence that the nonderivatives banks are not significantly affected by the bankruptcy announcement indicates that investors' fears are related to lack of transparency about derivatives activities.

[10] To conserve space, the detailed revised estimates based on the market model are not reported in Table 2.

7. Cross-sectional analysis of unexposed abnormal returns

In this section, we examine whether the variation in abnormal returns across the sample of unexposed securities is related to the proxies for size of speculative holdings of municipalities and banks. Moreover, a multivariate cross-sectional analysis allows us to perform more rigorous tests of the contagion hypothesis by investigating whether the previously reported contagion effects are attributable to other confounding effects.

7.1. Non-Orange County municipal bond funds and bonds

For the non-Orange County municipal bond funds and non-Orange County municipal bonds, we estimate the following ordinary least squares cross-sectional regressions with correction for heteroskedasticity.

Bond funds:[11]

$$\mathrm{AR}_i = \beta_0 + \beta_1 \mathrm{RATE}_i + \beta_2 \mathrm{INSUR}_i + \beta_3 \mathrm{LNSIZE}_i + \varepsilon_i \tag{3}$$

Bonds:

$$\begin{aligned} \mathrm{AR}_i = {} & \beta_0 + \beta_1 \mathrm{DER}_i + \beta_2 \mathrm{LNTAX}_i + \beta_3 \mathrm{RATE}_i + \beta_4 \mathrm{INSUR}_i \\ & + \beta_5 \mathrm{GO}_i + \beta_6 \mathrm{SINK}_i + \beta_7 \mathrm{LNSIZE}_i + \varepsilon_i . \end{aligned} \tag{4}$$

Given the concentrated market effect for bonds and bond funds on the day immediately following the bankruptcy announcement in Table 2, day 0 abnormal returns are used as the dependent variable. Column 2 of Table 3 presents the regression estimates based on the mean-adjusted abnormal returns reported in Table 2. The intercept represents abnormal returns after adjusting for the effects of the control variables RATE (default rating), INSUR (default insurance), and LNSIZE (net asset value). Consistent with the contagion hypothesis, the intercept estimate indicates that the average mean-adjusted abnormal return of municipal bond funds without direct exposure to the Orange county bankruptcy is −2.99%. This is not only significant at the 1% level, but it also suggests the contagion is much greater than the univariate mean negative abnormal return of 0.91% reported in Table 2. The coefficient estimates for the control variables are discussed below, along with those for the municipal bonds sample.

Columns 3 and 4 report regression estimates for non-Orange County bonds. To check for robustness, we use two fundamentally different measures of abnormal returns as the dependent variable: mean-adjusted abnormal returns (see Handjinicolaou and Kalay, 1984; Datta and Dhillon, 1993) and market model abnormal returns (see Brown and Warner, 1985; Johnson, Pari, and Rosenthal, 1989). The market model abnormal returns are estimated after accounting for the interest rate sensitivity of bonds. Because the results are robust to the method of measurement of abnormal

[11] The variables, DER, LNTAX, and SINK, found in the bond regression (4) are not included in the bond fund regression because the data are not available.

Table 3

Cross-sectional analysis of abnormal returns on non-Orange securities

Bond funds: $AR_i = \beta_0 + \beta_1 RATE_i + \beta_2 INSUR_i + \beta_3 LNSIZE_i + \varepsilon_i$, Bonds: $AR_i = \beta_0 + \beta_1 DER_i + \beta_2 LNTAX_i + \beta_3 RATE_i + \beta_4 INSUR_i + \beta_5 LNSIZE_i + \beta_6 GO_i + \beta_7 SINK_i + \varepsilon_i$, Bank stocks: $AR_i = \beta_0 + \beta_1 DEALER_i + \beta_2 USER_i + \beta_3 REPLACE_i + \beta_4 LNASSETS_i + \beta_5 LEV_i + \varepsilon_i$, the abnormal returns (ARs) for the bonds or bond funds are the abnormal return on December 7, 1994, the first day that investors could trade based on Orange County's bankruptcy announcement. The bank stocks' ARs are the abnormal returns for December 8, 1994, the day the *Wall Street Journal* announced that Merrill Lynch could be liable for part of Orange County's fund losses. For bond funds, RATE is the percentage of the *i*th fund's bonds that were rated A or higher by Standard & Poor's, $INSUR_i$ is a dummy variable where one indicates the *i*th fund contains insured bonds; and $LNSIZE_i$ is the natural logarithm of the *i*th fund's net assets under management. For bonds, DER is a dummy variable where one indicates the bond's issuing municipality was designated by *County and City Data Book* (1994) as having one of the ten largest aggregate tax bases (and was therefore likely to be a derivative user); LNTAX is the natural logarithm of aggregate tax base of the bond's municipality; RATE is a dummy variable where one indicates the bond was either not rated or rated below investment grade; GO is a dummy variable where one indicates the bond was listed as a general obligation bond; INSUR is a dummy variable where one indicates the presence of bond insurance for the bond; SINK is a dummy variable where one indicates the presence of a sinking fund for the bond; and LNSIZE is the natural logarithm of the bond's issue size. For banks, DEALER is a dummy variable where one indicates the bank is a derivative dealer; USER is a dummy variable where one indicates the bank is a derivative user; REPLACE is the bank's ratio of replacement cost (market value) of derivatives to total book value of assets; LNASSETS is the bank's natural logarithm of total book value of assets; and LEV is the bank's leverage ratio as calculated by dividing the *i*th firm's long-term debt by the sum of its long-term debt and equity. *N* indicates the sample size and the test statistics are in parenthesis.

	Non-Orange County municipal bond funds ($N = 50$)	Non-Orange County municipal bonds ($N = 240$)		Bank stocks ($N = 91$)
Variables	Mean-adjusted AR (%)	Mean-adjusted AR (%)	Market model AR (%)	Market model AR (%)
INTERCEPT	−2.99	−2.76	−2.20	−1.24
	(−2.80)***	(−4.50)***	(−4.56)***	(−0.88)
DEALER				−2.41
				(−2.22)**
USER				−1.57
				(−2.06)**
RATE	−0.01	−0.01	−0.02	
	(−1.80)*	(−0.09)	(−0.24)	
INSUR	−0.01	0.02	0.08	
	(−0.35)	(0.35)	(2.41)**	
LNSIZE	0.07	0.07	0.07	
	(1.50)	(2.25)**	(2.58)***	

(*continued*)

returns, we focus on the estimates based on the mean-adjusted abnormal returns. Consistent with the contagion hypothesis, the intercept coefficient indicates that the value of non-Orange County bonds drops on average by 2.76% at the bankruptcy announcement after controlling for other explanatory variables, and the loss is significant at the 1% level. The estimate is about twice as large as the univariate mean negative abnormal return of 1.15% (reported in Table 2) that does not control for other

Table 3 (*continued*)

Cross-sectional analysis of abnormal returns on non-Orange securities

	Non-Orange County municipal bond funds ($N = 50$)	Non-Orange County municipal bonds ($N = 240$)		Bank stocks ($N = 91$)
Variables	Mean-adjusted AR (%)	Mean-adjusted AR (%)	Market model AR (%)	Market model AR (%)
DER		−0.19	−0.16	
		(−2.26)**	(−2.47)**	
LNTAX		0.04	0.02	
		(1.13)	(1.06)	
GO		−0.23	−0.23	
		(−4.00)***	(−5.49)***	
SINK		−0.35	−0.23	
		(−5.40)***	(−4.72)***	
REPLACE				−0.02
				(−1.16)
LNASSETS				−0.15
				(−0.67)
LEV				−0.02
				(−0.87)
Adj. R^2	0.03	0.13	0.18	0.07

*** Indicates significance at the 0.01 level.
** Indicates significance at the 0.05 level.
* Indicates significance at the 0.10 level.

bond-specific characteristics. Given our geographically diverse sample of bonds, this finding supports the argument that the contagion spread to the entire municipal bond market.

To investigate further the contagion hypothesis, we use the aggregate tax base of the municipality to proxy for its derivatives holdings. In the model of financial contagion developed by Kyle and Xiong (2001), a primary determinant of the wealth amplification effect is the market position sizes of speculative traders (also see Ross, 2001). Lacking accurate information on the derivatives positions of municipalities, we conjecture that the largest municipalities, like large financial institutions, might resort to derivatives. We include a dummy variable DER_i with a value of one for bonds issued by municipalities with the ten largest aggregate tax bases as ranked by *County and City Data Book* (1994), and zero otherwise. We focus on the ten largest municipal bond issuers because their speculative losses are likely to be higher under contagion due to large derivatives positions. As expected, the significantly negative coefficient on DER shows that bonds issued by municipalities with the largest aggregate tax base suffer an additional 0.19% loss. These bonds suffer more heavily despite their mean rating of AA+. To the extent the tax base is a reliable proxy for derivatives usage, this finding implies that unexposed municipalities with larger derivatives positions suffer greater losses. An alternative plausible explanation for this result is in terms of lack of transparency. Investors might have punished the bonds of large municipalities simply on the suspicion of speculative derivatives holdings.

However, the contagion effect could be moderated by a greater likelihood of government intervention for larger municipalities than smaller municipalities. To control for this "too-big-to-fail" effect, we use the natural log of aggregate tax base of the ith bond's municipality, LNTAX_i, as an added explanatory variable. The positive coefficient estimate for LNTAX is consistent with the idea that municipalities with larger aggregate tax bases are better able to bear the shock of the bankruptcy, but the estimate is not statistically significant.

Variables for credit rating, insurance, and size are included as regressors for both the bond fund and bond equations to control for effects attributable to these firm characteristics. In the bond funds regression, RATE_i is the percentage of the ith fund's bonds that are rated below A by S&P as reported in the fund's 1994 annual report. For individual municipal bonds, RATE_i assumes a value of one if the ith bond is either not rated or rated by Bloomberg as below investment grade and zero otherwise. Similarly, insured assets are less exposed to default risk and should be less negatively impacted by the announcement (see Kidwell, Sorensen, and Wachowicz, 1987). The dummy variable INSUR_i equals one if the ith fund contains insured bonds as reported in their 1994 annual report and zero otherwise. For municipal bonds, INSUR_i equals one if the bond is insured and zero otherwise. The results for RATE and INSUR are mixed.

Crabbe and Turner (1995) posited that a bond with a large issue size is likely to have greater liquidity and lower information costs because it is more likely to be actively traded and have a larger analyst following with greater availability of public information about the financial health of its issuer. We check for potential liquidity effects by adding $\text{LNSIZE}_{i.}$ This variable represents the natural logarithm of the ith bond fund's net assets under management as reported in their 1994 annual report and the natural logarithm of ith bond's issue size. As expected, the coefficient for LNSIZE is positive and statistically significant at the 5% level, indicating that municipal bonds with a smaller issue size are more negatively impacted.

We are able to obtain data on two additional characteristics but only for bonds. Kidwell and Koch (1982) indicated that under normal circumstances general obligation bonds are less risky than other types of bonds, such as revenue bonds, because they are secured by the "full faith, credit, and taxing authority" of the issuer. In contrast, revenue bonds are paid off from a project's revenues and have less to do with municipalities' financial prowess. Lamb, Leigland, and Rappaport (1993) noted that, on occasion, revenue bonds can have a stronger credit quality than general obligation bonds because revenue bonds can be insulated from the political process and can collect payments quicker. The Orange County bankruptcy could have shaken investors' confidence in the creditworthiness of unexposed municipalities. Therefore, we include the dummy variable GO_i, where one indicates the ith bond is listed on Bloomberg as a general obligation bond and zero otherwise. The coefficient for GO is significant at the 1% level and shows that losses suffered by general obligation bonds is 0.23% more than those by nongeneral obligation bonds.

Because the presence of a sinking fund decreases a bond's default risk and agency costs (Boardman and McEnally, 1981), sinking fund bonds should be less negatively impacted by the announcement. However, the coefficient estimate for SINK, where one indicates the presence of a sinking fund for the ith bond and zero otherwise, is negative and statistically significant at the 1% level. A possible explanation for this unexpected result is that the sinking fund bonds in our sample have a longer maturity and are more price-sensitive to changes in risk.

A competing plausible explanation for the observed negative abnormal returns is that investors in unexposed municipal bonds and bond funds revised the default probabilities upward after the Orange County bankruptcy announcement. However, the breadth of the observed negative wealth effect in our diverse sample of unexposed bonds is remarkable. In the non-Orange County bond funds sample, 80% of the bonds on average are rated A or higher (see Panel A of Table 1). Further, 89% of non-Orange County bonds are rated investment grade or higher, and 54% of the non-Orange County bonds in our sample are insured (not reported in Table 1). We agree that one of the important reasons for wide spread negative price reaction is reassessment of default probabilities. In addition, we believe that there are other important reasons such as investor irrationality, lack of transparency about derivatives holdings and information asymmetry, and portfolio rebalancing as pointed out in the contagion literature. Limitations of data availability make it difficult to construct tests that can discriminate among multiple explanations. We try to control for bankruptcy risk by adding proxies such as default rating (RATE), default insurance (INSUR), and sinking fund (SINK) in the cross-sectional regressions presented in Table 3. It is important to note that we observe negative abnormal returns even after controlling for these proxies for bankruptcy risk. This leads us to claim that the spillover effects of Orange County bankruptcy are deeper than an increase in investor perceptions about the likelihood of default. The models of financial contagion provide a more complete explanation for the widespread significant negative wealth effects.

Overall, the continued significance of the intercept estimates for non-Orange municipal bond funds and bonds is consistent with the hypothesis that the contagion effect extends to the entire municipal bond market. The bankruptcy not only affected bonds in Orange County, but investors' negative reactions also spread to bonds issued by municipalities outside Orange County. Larger counties that are more likely to use derivatives extensively suffered greater losses.

7.2. Unexposed banks

Based on abnormal returns from the market model for banks other than Merrill Lynch, we estimate the following ordinary least squares regression using the White (1980) correction for heteroskedasticity:

$$\begin{aligned}\mathrm{AR}_i = \beta_0 &+ \beta_1\mathrm{DEALER}_i + \beta_2\mathrm{USER}_i + \beta_3\mathrm{REPLACE}_i \\ &+ \beta_4\mathrm{LNASSETS}_i + \beta_5\mathrm{LEV}_i + \varepsilon_i. \qquad (5)\end{aligned}$$

The dependent variable is taken from abnormal returns for day +1 shown in Panel C in Table 2 when the *Wall Street Journal* reported the potential liability of Merrill Lynch, the major seller of derivative products to Orange County fund. Because the lack of transparency about the usage of over-the-counter derivatives seems to be the main channel of contagion, we test the contagion hypothesis by using four variables to proxy for the size of derivatives positions of banks. DEALER_i is an indicator variable where one indicates the ith bank is a dealer bank and zero otherwise. USER_i assumes a value of one if the ith bank is a user bank and zero otherwise. We expect the coefficient on DEALER will be more negative than the coefficient on USER because of the larger derivatives holdings of dealer banks. The intercept term captures the impact of the announcement on nonderivatives banks after controlling for other effects. From the last column of Table 3, the intercept estimate shows that stockholders in the nonderivatives banks experience an average abnormal loss of 1.24% after controlling for asset size and leverage, but the loss is not statistically significant. In contrast, banks that use derivatives experience an additional average loss of 1.57%, whereas their counterparts that not only use but also deal in derivatives sustain an incremental loss of 2.41%. These conditional estimates are substantially larger than the base level estimates of −0.55%, −0.69% and −1.14%, respectively, for the nonderivatives, user and dealer banks reported in Table 2. The greater mean loss sustained by dealer banks is consistent with their larger derivatives positions and with the prediction of recent theoretical models that the contagion effect varies directly with the size of market positions and inter-institutional cross-holdings of banks. Despite the noise in the dependent variable (abnormal returns for day +1 rather than day 0), it is remarkable that our findings are supportive of a derivative based contagion hypothesis.

Sinkey and Carter (1999) found evidence to suggest that more negative abnormal returns are associated with larger ratios of replacement cost of derivatives to total assets and the natural logarithm of total assets. Therefore, we include REPLACE_i, the ith bank's ratio of replacement cost (market value) of derivatives to total book value of assets. LNASSETS_i, represents the ith bank's natural logarithm of total book value of assets. Finally, we add the control variable LEV_i, the ith bank's leverage ratio as calculated in Gilson (1997) by dividing the ith firm's long-term debt by the sum of its long-term debt and equity. The coefficient signs for REPLACE, LNASSETS, and LEV are consistent with our expectations but are not statistically significant.

A plausible alternative explanation is that the bank stock prices fell because of the likelihood of lawsuits by clients following the announcement of Orange County bankruptcy. Specifically, brokers that engaged in reverse repurchases with Orange County (other than Merrill Lynch, which is classified as a directly exposed institution and is excluded from this cross-sectional analysis of unexposed banks) ran the risk of being sued by their clients. Because these brokers are covered by our DEALER binary variable, the corresponding significant negative coefficient estimate is consistent with the legal liability argument. However, we also find a significant negative stock price reaction for a diverse sample of 29 USER banks. Again, we believe the breadth of the ripple effects is better explained by the models of financial contagion.

Overall, the bank regression results show the contagion effects in the aftermath of the Orange County bankruptcy announcement spread beyond the municipal bond market to banks involved with derivatives. In addition, banks with greater exposure to derivatives suffered greater losses. However, the finding that stockholders in non-derivatives banks suffered only an insignificant loss suggests that the Orange County bankruptcy stopped short of turning into a systemic threat.

8. Summary and conclusions

The Orange County, California, bankruptcy announcement on December 6, 1994, is a major crisis event in public finance. This catastrophe is primarily a financial event due to a failed derivatives strategy involving extreme leverage rather than the result of real operating factors such as falling tax revenues and rising expenses. We investigate whether the bankruptcy is an idiosyncratic county-specific event as many have argued (which we label as the local effects hypothesis) or a financial contagion with widespread adverse wealth effects across the economic landscape (our contagion hypothesis). Using the standard event study methods, we extend Denison's (2000) findings that the bankruptcy affected municipal bonds issued by the county. More importantly, our results show that the Orange County crisis is also associated with a significant decrease in the value of bond funds without direct exposure to Orange County and bonds issued by a geographically diverse sample of other municipalities. Moreover, larger counties that are more likely to carry bigger derivatives positions suffer significantly greater losses. Finally, even commercial and investment banks that use or deal in derivatives suffer significant losses in market values of equity at the announcement. The average loss suffered by dealer banks is greater than that for banks that are only derivatives users. However, stockholders at banks that neither use nor deal in derivatives are not affected. These results are consistent with the rational theories of financial contagion, such as of Allen and Gale (2000) and Kyle and Xiong (2001), which predict that the contagion effect varies directly with the size of the overlapping claims and the speculative positions of traders.

We draw two main conclusions from these results. First, despite being triggered by a purely financial event, the Orange County bankruptcy produced a widespread financial contagion. It led to extensive collateral damage, infecting not only the entire municipal bond market but also bank stocks. Second, it did not pose a systemic threat in that unexposed bank stocks were not affected. Thus, equity markets are quite adept at sorting out noisy information to discriminate between those firms that are vulnerable and those immune to an event risk. In contrast, significant losses sustained by non-Orange County bonds and bond funds suggest that the municipal bond market was hindered in pricing securities by the lack of transparency with respect to the derivatives positions of local governments. These results underscore the need for proper regulatory measures to promote adequate internal controls for municipal investments and public disclosure of their derivatives holdings.

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