The Value of Implicit Guarantees

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Abstract

Firms considered "too big to fail" (TBTF) benefit from access to cheaper funding during crises. Using a comprehensive data set of bond characteristics and prices in the primary and secondary market for a sample of 74 U.S. financial institutions, we investigate how reduced debt capital costs affect the positions of shareholders and creditors. Issue and transaction prices are revalued on the basis of a funding advantage estimated using a structural model. Our results indicate that wealth transfers to investors sum up to $365bn and that banks shifted to fixed-rate short-term funding to take advantage of their TBTF status.

Keywords: Financial crisis, Systemic risk, Too big to fail, Government guarantees
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The 2007-2008 financial crisis culminated in the bankruptcy of Lehman Brothers on September 15, 2008 and led to unparalleled concerted efforts by authorities to stem the germ of financial contagion and avoid the collapse of the financial system. The magnitude of actual support extended to financial institutions is historically unique and has been surveyed by Panetta et al. (2009), who find that amounts guaranteed, insured or injected by governments add up to $5bn. The direct effects of these interventions on stock and debt prices have been the subject of a number of studies, like Schweikhard (2012) and King (2009). The indirect effects of bailouts, that is, the change in beliefs of market participants about the future involvement of the government, are harder to assess as they build up gradually beneath the surface and are not observable. Yet, they are of importance to financial markets as they impact the value of every claim against a benefiting financial institution. A debt security by an issuer who is deemed less likely to default on his liabilities than under different circumstances will bear a lower risk-adjusted spread over the risk-free rate. This funding advantage can translate into tangible monetary benefits. The aim of the study at hand is to provide estimates of the value of implicit guarantees extended to the financial sector during the crisis. Which financial institutions benefit from these subsidies, to what extent, and how are these gains split up between shareholders and creditors?

Using a comprehensive data set of bond characteristics and prices at the primary- and secondary-market level, we investigate how the reduced debt capital costs affect the positions of shareholders and creditors. The equity side capitalizes on the lower nominal interest rate at the time of issuance that increases the return on equity, while the advantage on the debt side stems from a (partial) offset of the deterioration in market value as the firm gets distressed. In a first step, we rely on a structural default model to estimate the credit spread evolution over the period 2007-2010 for the counterfactual case of absence of guarantees. The model is calibrated to the pre-crisis regime in line with Schweikhard and Tsesmelidakis (2012), who find evidence of a structural break in the pricing of bank debt during the financial crisis. The idea is that the number and extent of interventions led to a growing market belief that financial institutions are actually too big to fail (TBTF), and even if such a belief prevailed already before the crisis, that guarantees only became worthy in times of turmoil, similar to a put option getting closer to the money. Deducting the observed market spreads from their model counterpart and adjusting for the influence of counterparty risk, we arrive at estimates for the TBTF premium that vary across issuers, time, and maturities. In a second step, we revalue the offering or transaction price of each security by augmenting either the yield-to-maturity or the coupon rate by the spread differential. Contrasting the revalued to the actual price, we obtain the "capitalized subsidy" that reflect all accrued future benefits throughout the life of a bond in present value terms. Our results show that wealth transfers to shareholders and debtholders amount to \$129.2bn and \$236.1bn, respectively. Most subsidies accrue by far to the banking subsector, and the period from October 2008 to June 2009 accounts clearly for most of the subsidies. This is not surprising given that most important rescue packages were decided on in fall 2008 – the determination demonstrated by the government led to a peak in the estimated funding advantage, and trading and issue activity also recovered from the uncertainties of the year 2008 and sloped upwards. An analysis of the determinants of the subsidies shows that they are indeed highly related to proxy variables for company size, default correlation, systemic risk, and the like. Their explanatory power is quite high at 34.5%, thus lending further support to our results.

The rich bond data set also affords us the opportunity to analyze the financing decisions of banks during the crisis. We find that while other companies chose fixed-rate long-term debt when interest rates were low, banks went their own way focused on short maturities. In doing so, banks could avoid the high premiums associated with long-term debt given the steepness of the yield curve at that time, which already reflected inflationary expectations, and capture once more a benefit from their TBTF status (Stein (2010)).

In a related study, Veronesi and Zingales (2010) estimate the wealth transfers from taxpayers to the nine largest U.S. banks surrounding the announcement of the "Revised Paulson Plan" in October 2008. They find that the direct benefits to the debt outstanding and the equity, less the value of the preferred equity and warrants the government received in return, imply a redistribution of \$21 to \$44bn from taxpayers to banks. Whereas their analysis focuses on the effects of an explicit intervention, our study sheds light on the substantial wealth transfers to financial institutions that result from their implied, unofficial TBTF status. To the best of our knowledge, this is the first paper to study this question and present empirical results.

Furthermore, we contribute to the discussion on the optimal government policy with respect to financial crises in the future, as our results hint at the indirect costs associated with the rather microprudential policy pursued to date. The subsidies curtail competition, distort prices, and give disastrous incentives to more risk-taking. We argue that robust schemes for the resolution of failed banks combined with a taxation system based on banks' contribution to systemic risk (Acharya et al. (2010a)) are needed to convince the market that they are not TBTF anymore.

In the remainder of the paper, we proceed as follows. Section I explains how we arrive at estimates for the funding advantage of government-backed institutions. In Section II, we describe the bond issue and transaction data sets and discuss the financing decisions of financial institutions. In Section III, we present estimation results for the subsidies perceived by debtholders and shareholders, and relate secondary-market subsidies to possible determinants. Concluding remarks follow.

I. The Funding Advantage of Too-Big-To-Fail Institutions

Financial institutions deemed too big to fail by the market benefit from better financing terms than other companies. In Section III, we will calculate the resulting subsidies to shareholders and creditors based on comprehensive bond issue and transaction data for a sample of 74 financial institutions. But how to come up with a sensible estimate for the size of the funding advantage?

In a companion paper, Schweikhard and Tsesmelidakis (2012) show how a structural credit model can be useful in producing credit spread estimates for the counterfactual case of no government support. The model-market spread difference is then basically interpreted as the value of the guarantee in basis points (bps), consistent with Merton (1977) who recognized that financial guarantees act as put options on the guaranteed underlying asset. We will walk through the essential aspects of our procedure in the following.

A. Approximation of Bond Yield Spreads Using Credit Default Swaps

Although in the later steps of the subsidy estimation we consider various types of bonds, on theoretical and empirical grounds, the calculations of the funding advantage will rely on data from the credit default swap (CDS) market.

A CDS hedges the buyer against the default risk of a specified issuer, although it is not necessary for her to actually own any of the issuer's debt, i.e., the CDS can merely be used for speculation. The protection seller receives fixed payments which, over a year, sum up to the CDS spread in percentage points times the notional principal. In exchange, the buyer has the right to sell bonds by the specified issuer at their face value when a credit event occurs, after which the contract terminates prematurely.

Due to their nature, one expects CDS spreads to behave similarly to their cash market counterparts. As Duffie (1999) points out, there exists a non-arbitrage relationship between CDS and bond spreads. Under ideal conditions, a long position in a CDS can be synthesized by short-selling an underlying floating-rate bond with a spread over Libor and taking a long position in a (nearly risk-free) floater on Libor without a spread. However, for most practical purposes, an exact replication is not feasible and the equivalence holds only approximately. The difference between the CDS spread and the bond spread over the risk-free rate is defined as the CDS-bond basis. Quite a lot of studies have confirmed that empirically the arbitrage mechanism holds well before the crisis and that the basis only tends to get slightly positive, if at all. For instance, Blanco, Brennan, and Marsh (2005) report an average basis of just +5 bps and attribute this departure from parity to the cheapest-to-deliver option contained in most CDS contracts and to short-selling difficulties of bonds. On the other hand, several authors have reported a significant negative basis of up to -200 bps during the financial crisis (Bai and Collin-Dufresne (2011), Fontana (2010)), which is likely to be caused by counterparty risk in the CDS market and illiquidity related to bonds, both widening the basis. In our approach, we try to mitigate basis-induced biases as explained later.

Despite these imperfections, the CDS is still the instrument of choice for any analysis centered around the impact of guarantees on default risk. First, since CDSs allow to trade default risk directly, their rates provide a cleaner measure than any other instrument, including bonds that are affected by nondefault factors such as short-sales restrictions and interest rate risk. Accordingly, structural factors can explain CDS spreads fairly well, while the results for bond spreads have been less conclusive (Ericsson, Reneby, and Wang (2007), Blanco, Brennan, and Marsh (2005)). Second, individual corporate bonds have been reported to be relatively illiquid at times and particularly during the financial crisis, thereby providing imperfect times series for empirical work. Finally, several papers show that the CDS moves ahead of the bond market in price discovery and that CDS premiums thus are more sensitive to changes in creditworthiness (see, e.g., Longstaff, Mithal, and Neis (2005), Blanco, Brennan, and Marsh (2005), Forte and Peña (2009)).

B. Estimating Support-Free Credit Spread Levels

Our first goal is to estimate credit spread levels that abstract from possible implicit guarantees, illiquidity, counterparty risk, and other imperfections, but solely reflect the default risk of the debt, thereby providing a benchmark for market observations.

Merton (1974) presents a model in which the default risk of a firm and hence the value of its debt essentially result from its asset value, asset volatility, and capital structure. In this setting, equity and debt are contingent claims on the asset value process and their prices obtained similarly as in Black and Scholes (1973). While the original paper focuses on the price of a zero-coupon bond, thereby ruling out default before maturity, there has been a long literature dedicated to generalizing the framework and making it more adaptable to real-world settings, like first-passage models allowing for default anytime (Black and Cox (1976)) and models incorporating jumps in the distance to default (Zhou (2001), Finger et al. (2002)). Empirically, the performance of structural models in predicting corporate bond spreads has been mediocre (Jones, Mason, and Rosenfeld (1984), Eom, Helwege, and Huang (2004)), while they have been shown to be successful with CDS spreads (Zhang, Zhou, and Zhu (2009), Ericsson, Reneby, and Wang (2007), Schweikhard and Tsesmelidakis (2012)), the reason being that the former reflect more nondefault components than the latter (Schaefer and Strebulaev (2008), Leland (2004)). We base this study on the framework presented in Finger et al. (2002) and Finger and Stamicar (2006) as we have shown in Schweikhard and Tsesmelidakis (2012) that it performs very well when calibrated appropriately. Below, for completeness, we briefly present the most relevant technical aspects and refer the reader for more details on the implementation and discussions to our companion paper.

Firm assets V follow the process

$$\frac{dV_t}{V_t} = \mu_V dt + \sigma_V dW_t, \tag{1}$$

where W_t is a Brownian motion, σ_V denotes the asset volatility, and μ_V the drift.

There is a default threshold B that equals LD, where L is defined as the average recovery rate of firm debt D. The barrier is assumed stochastic with L following a lognormal distribution with mean $\overline{L}$ and standard deviation λ, and its true level is only revealed at default, i.e., when the asset value process crosses the barrier.

It can be shown that the risk-neutral survival probability $P(t)$ that the firm value does not hit the default boundary until time t has the approximate closed-form solution

$$P(t) = \Phi\left(-\frac{A_t}{2} + \frac{log(d)}{A_t}\right) - d \cdot \Phi\left(-\frac{A_t}{2} - \frac{log(d)}{A_t}\right), \tag{2}$$

with

$$d = \frac{S_0 + \overline{L}D}{\overline{L}D} \exp \lambda^2, \tag{3}$$

$$A_t^2 = \sigma_V^2 t + \lambda^2, \tag{4}$$

where $\Phi(\cdot)$ is the cumulative normal distribution function and σ_V denotes the asset volatility. The asset volatility is then approximated by the linear relation

$$\sigma_V = \sigma_S \frac{S}{S + \overline{L}D}, \tag{5}$$

where S denotes the stock price, σ_S the equity volatility, and D the debt per share. We rely on the implied volatility of stock options as an estimate of future volatility, since the lagging behavior of historical volatilities makes them less adequate in a crisis setting.

Deriving and equating the present values of the protection leg and the premium leg of the contract yields the following solution for the premium c of a CDS with maturity T:

$$c = r(1-R)\frac{1 - P(0) + e^{r\xi}(G(t+\xi) - G(\xi))}{P(0) - P(t)e^{-rt} - e^{r\xi}(G(t+\xi) - G(\xi))}, \tag{6}$$

with

$$G(u) = d^{z+\frac{1}{2}}\Phi\left(-\frac{log(d)}{\sigma_V\sqrt{u}} - z\sigma_V\sqrt{u}\right) + d^{-z+\frac{1}{2}}\Phi\left(-\frac{log(d)}{\sigma_V\sqrt{u}} + z\sigma_V\sqrt{u}\right), \tag{7}$$

where $z = \sqrt{\frac{1}{4} + \frac{2r}{\sigma_V^2}}$, $\xi = \frac{\lambda^2}{\sigma^2}$, r is the deterministic risk-free interest rate, and R is the expected recovery rate to a specific debt class.

A structural model's predictive ability depends on a reasonable estimate of firm leverage. While the equity part is easily obtained from the stock market, the debt is often approximated using book values. In this context, Duffie and Lando (2001) also emphasize the relevance of incomplete accounting information. The leverage of financial institutions is particularly hard to assess because large parts of their liabilities are secured, insured or off the balance sheet. To alleviate this problem, we accommodate the model to market-based firmspecific credit information by allowing $\bar{L}$ to fluctuate while minimizing the sum of squared errors between model and market prices over a number of trading days, thereby adjusting the default barrier and the leverage ratio endogenously, consistent with the theory behind Leland (1994) and Leland and Toft (1996) about the endogeneity of bankruptcy. Since D is equal to the total liabilities, the leverage is thus inferred from a combination of book and market data.

The applied calibration method follows the basic (constant-default barrier) scheme in

Schweikhard and Tsesmelidakis (2012)[1], where, for each firm, we determine $\bar{L}$ using a number of observations over the estimation period from January 2003 through July 2007 by minimizing the sum of squared errors between model and market spreads. Thereby, we implicitly distinguish the pre-crisis regime until July 2007 from subsequent periods. Actually, the further analyses in Schweikhard and Tsesmelidakis (2012) clearly hint at a regime shift in market participants' valuation of bank debt in the course of the crisis. Hence, we generate model spreads throughout the crisis while holding market anticipation constant at its presumably "uncontaminated" pre-crisis level.

[Insert Table I about here]

C. Data and Descriptives

For the estimation of the funding advantage, we rely on CDS data by the *Markit Group*. To obtain our sample, on the company level, we start with all listed financial companies that have not defaulted before the financial crisis. On the CDS level, we discard the subordinated class of contracts and CDSs suffering from strong illiquidity. More precisely, we require a CDS series to possess a minimum of 150 daily observations in the two years immediately preceding mid-2007, and at least 100 observations thereafter. Finally, the swaps surviving this filtering are matched against firm-level information.

For the estimation of benchmark CDS spreads under the structural framework described in the previous subsection, we first collect daily stock prices and numbers of shares outstanding from *CRSP* and apply the usual adjustments for stock splits, dividends, and other capital measures. Quarterly balance sheet items, monthly Standard & Poor's (S&P) issuer ratings, and *Global Industry Classification Standard* (GICS) codes are from *Compustat*. We apply a few adjustments at the subsector level in that we reclassify firms like Goldman Sachs and Morgan Stanley that were originally in the "Diversified Financials" rubric by GICS as "Banks." The remaining diversified financial companies form a new group labeled "Others." Concerning the option data, we infer the one-year

[1]More precisely, the standard deviation of the barrier, λ, is set to 0.3, the debt class specific recovery rate R is set to 0.5, the risk-free interest rate r is assumed to be the five-year constant maturity zero-coupon swap rate, the equity volatility σ_S is the one-year at-the-money implied volatility from put options, and the calibration grid density is set to 10.

implied volatility of at-the-money put options of the *IvyDB OptionMetrics* volatility surface file. All the raw data from the above mentioned sources are cleaned for missing or invalid observations.

The remaining sample comprises 108,448 daily observations from January 2002 to September 2010 for 74 U.S. finance companies. The constituents of our company sample are detailed in Appendix A and summary statistics are reported in Table I. It is noteworthy that the average total assets and total liabilities for banks as well as AA institutions rose steadily, even throughout the crisis, while the market capitalization fell, suggesting that creditors have been better off than shareholders. This lends support to our premise that stock prices should be less affected by the anticipation of intervention than CDS rates. This observation still holds when we consider total amounts (by multiplying the number of firms with the averages). However, an alternative explanation could be that firms grew through the acquisition of companies outside the sample, and this would need to be verified by adjusting asset growth accordingly.

[Insert Table II about here]

D. Estimation Results

In Table II, we present results for our support-free, model-implied CDS spreads. In the pre-crisis period (before August 2007), the model underpredicts observed spreads by 7 bps on average, which is a stylized fact in the literature (see e.g., Eom, Helwege, and Huang (2004)), a common explanation being that market prices are susceptible to illiquidity.

In the crisis period, the average spread differences climb in general with an average deviation of 183 bps, but not uniformly across subsectors. Banks are clearly most affected with an average pricing error of 350 bps, followed by insurance companies with 134 bps. Real estate companies exhibit much lower mean errors, and other financials are hardly affected at all. Finally, the deviations tend to diminish in the post-crisis period but do not fade away completely, except for the insurance industry.

To gain a better understanding of the timing of the deviations – which we henceforth refer to as the wedge –, we graphically study the evolution of market and model spreads in Figure 1. The wedge progressively builds up from the onset of the crisis in mid-2007, peaks around the turn of year 2009, and slowly reverts back afterwards, although it still persists at the end of the sample period. In direct comparison, the wedge is much more pronounced in the lower plot that focuses on the banking subsample than in the aggregate financials graph, in line with our tabulated results.

[Insert Figure 1 about here]

E. Adjustment for Counterparty Risk and the Role of Liquidity

In this subsection, we describe why and how we account for potential biases in the wedge as a measure of the funding advantage, most notably counterparty risk.

In the context of CDSs, counterparty risk is the credit risk arising from the possibility that the insurer may default on his obligation in a credit event. In a calm environment, counterparty risk only plays a negligible role in CDS trading as the mark-to-market mechanism helps to minimize the losses of the protection buyer in case the counterparty fails prior to the credit event, and the extreme case of simultaneous default is rare. Having said that, in a crisis environment, the protection buyer faces significant risks, for example because marking-to-market may then work imperfectly due to jumps in credit quality and to the rising costs for new credit protection. Since protection buyers anticipate such a joint event, they discount CDS premiums accordingly. The impact of counterparty risk on CDS spreads clearly depends on the correlation between the default probability of the insurer and the reference entity, or their joint default probability, and these are likely to be particularly high in the case of contracts written on large financial institutions as they happen to be the primary dealers and thus counterparties in the CDS market. The issue of counterparty risk is relevant for this study as it moves market premiums downwards, thus in the same direction as government guarantees.

We adjust the model-market deviations for counterparty risk in a straightforward linear way following Schweikhard and Tsesmelidakis (2012): First, we construct a primary dealer index based on the list by the Federal Reserve. The index values are the average of each constituent's CDS spread weighted by its market capitalization. In the second step, for each company in our sample, we calculate daily beta values $\beta^{PD}_{r_{CDS}}$ as the historical covariance of the CDS return and the primary dealer index return divided by the variance of the index return. Third, we run a pooled regression of the deviations on $\beta^{PD}_{r_{CDS}}$ and a number of control variables related to liquidity, business climate and ratings. This results in coefficient estimates for $\beta^{PD}_{r_{CDS}}$ of 367, 58, and 27 bps for one, five, and ten-year CDSs, respectively. In the fourth and final step, by multiplying these coefficients with the $\beta^{PD}_{r_{CDS}}$ values, we obtain the counterparty risk adjustment for a given firm, maturity, and date. The average adjustment across time and firms amounts to 25 bps but can become quite high at times.

As to the issue of illiquidity in CDS markets, we do not account specifically for it as in theory it should drive up market prices while leaving model estimates unaffected, thereby reducing price deviations. Therefore, at worst, we underestimate the wedge. However, in practice, CDS bid-ask spreads as reported by *Bloomberg* narrowed during the crisis, suggesting that liquidity was even higher than before and hence not decisive.

In summary, the funding advantage used in this paper to calculate implicit subsidies to financial firms is defined as the wedge minus the counterparty risk adjustment. Figure 1 plots its evolution. As can be seen, the funding advantage is slightly smaller than the difference between the two credit spread curves.

[Insert Table III and Figures 2 and 3 about here]

II. Bank Financing Decisions

In this section, we introduce the datasets on bond issues and bond transactions used to estimate the total value of the subsidies. At this occasion, we take the opportunity to shed light on how banks' financing decisions evolved during the sample period.

A. Bond Issues

We retrieve information on individual bond offerings from the *Mergent Fixed Income Securities Database (FISD)*, a comprehensive source for U.S. public debt offerings.[2] Based on our sample of 74 companies, we include all available parent companies and their subsidiaries. In Table III we break down bond information across three key periods of equal length, as well as across subsectors (Panel A) and ratings (Panel B). The first group of columns from left to right indicate the number of bond issues that took place, their aggregated offering amounts, also split up by fixed-, floating-, and zero-coupon types. We also present the average offering amounts outstanding over the total debt amounts as reported from quarterly filings in *Compustat*. In the middle columns, we report average maturities of new issues as well as issue-volume-weighted means. A number of observations can be made:

First, while the number of issues remained generally at the same level throughout the three periods, issue volumes slumped after the crisis. However, the average total debt outstanding from firms' quarterly filings rather increases monotonically throughout our sample. These observations are not in contradiction, as they could simply mean that while financials had still a lot of debt in their books in the post-crisis period, the issue volume could be an early indication that in the face of tighter regulation they then headed for lower debt levels in future by liquidating assets at the same time. As pointed out by Hanson, Kashyap, and Stein (2011), microprudential regulation just requires troubled banks to improve their capital ratios, be it by raising new capital or shrinking assets. Furthermore, Figure 2 plots the evolution of issue numbers and amounts for banks alone and the financial sector altogether. From this perspective, it is evident that issuance rose slowly as the crisis began and spiked up around large interventions like the bailout of Bear Stearns and the comprehensive support programs in fall 2008. In contrast, the Lehman Brothers bankruptcy marked an all-time low.

Second, while the floating-rate bond issuance exceeded its fixed-rate counterpart by

[2]Some exclusions apply: The database does not systematically track publicly traded bonds that are issued outside of the United States, although sometimes foreign issues are included when the *Mergent* team comes across them. Further, neither Certificates of Deposit nor asset-backed securities are part of the offer.

far in the beginning, the relation reversed in the crisis and persisted this way thereafter. From Figure 3 in which we take a closer look at this development for the bank case, it appears that the share of floaters steadily increased throughout the first three quarters of 2007, almost completely crowding out the fixed-rate bonds, but then suddenly dropped and remained at around 30%. An explanation for the first observation could be that banks took advantage of their private information and, anticipating the approaching crisis, offered their bond issues at floating rates to benefit from a lower interest rate after the crisis unfolds and the government takes appropriate actions. Later on, when interest rates fell, they switched over to fixed-coupon funding to lock in a level that appeared attractive by historical standards.

[Insert Figures 4 and 5 about here]

Third, maturities and weighted maturities of new issues shortened during the crisis but recovered later on. Figure 4 depicts the evolution of the two metrics for banks. Their contrast is especially striking around the turn of year 2007/2008: While the average maturities are in the middle of a downward trend, adjusting for issue sizes reveals that banks in fact aimed at securing contemporaneous rates. In the case of fixed-coupon issues, the weighted maturity decrease reached 60% for banks as compared to 20% in the insurance subsector. In Figure 5, we decompose the weighted maturity according to different ranges. We note that banks seem to be hoarding long-term debt until the second quarter of 2008 before switching to much shorter tenors at the peak of the crisis. From mid-2009 on the maturity structure reverts back to its pre-crisis pattern.

A possible interpretation for banks selecting shorter maturities, especially in the case of fixed-rate bonds, might be that while short-term rates were at record lows, forward rates were reflecting expectations of future rate increases, manifesting in a very steep upward yield curve. As a result, issuers had to pay an expensive premium over floating-rate to emit long-maturity fixed-rate debt. In this situation, banks may have chosen to take a profit out of their TBTF status, trading in certainty for lower premiums, and thereby betting on their government support should they become hard-pressed to rollover their debt. This finding is in line with Stein (2010), who also shows that banks will try to benefit from cheap short-term debt without internalizing the costs it bears, especially in imposing a fire-sale cost on other firms holding the same assets. We revisit the question of a shortage of investor demand for long-term securities as a possible alternative explanation in the next subsection.

Fourth, the share of bonds outstanding among total debt remained roughly constant at about 30% for banks as well as financials altogether.[3]

The results for AA- and A-rated bonds exhibit a similar pattern to the banks' case discussed above. Apart from that, the issuance generally shifted from the other classes to AA.[4]

B. Bond Trades

We incorporate bond transaction data from the *Trade Reporting and Compliance Engine (TRACE)* into the analysis by exploiting the link with issue-level data provided by *Mergent*. *TRACE* essentially covers all over-the-counter bond transactions in the U.S. and provides intra-day-level information on the prices, volumes, and yields of transactions. For the purpose of our study, we first aggregate intra-day records at a daily frequency, retaining end-of-day prices and total daily volumes. In this process, we clean up the data for trade cancellations and corrections.

[Insert Figure 6 about here]

The columns on the right of Table III summarize our sample for the given periods. Contrary to the common wisdom that bond markets dried up, our statistics suggest that overall neither the number nor the volume of trades fell in the crisis as compared to the pre-crisis period – both numbers remain essentially unchanged. However, in the case of banks, activity shifted from long-term to short-term debt as investors paid most attention to bonds with a maturity less or equal five years. For the other subsectors, the relations remained unchanged. In the post-crisis period, attention shifted back to higher-maturity securities, and more noticeably trading volumes exploded throughout the cross-section.

[3]For this metric, we take into account all active bonds in a given period, not just those issued therein.
[4]The rating classifications used in this table are as per May 2007.

Figure 6 confirms these evolutions graphically. Additionally, it shows that trading activity fell sharply around the Lehman collapse before it reached new heights in the context of announcements of the comprehensive rescue packages in fall 2008.

These statistics afford us the possibility to revisit the question raised in the last subsection whether the low issue volume of long-term maturity debt could be a demand-side effect. The still considerable trading volume of long-term debt argues against this hypothesis.

Looking at our sample from a rating perspective, our observations for the bank subsector similarly hold for the AA category, which can certainly be ascribed to the substantial overlap of companies between both groups.

C. Determinants of the Bond Structure

Next, taking our previous observations as the starting point, we aim to devise stronger conclusions by analyzing the maturity structure and the fixed-to-floating mix in a more formalized manner. More importantly, comparing the bond descriptives and the funding advantage estimated in Section I collectively begs the question how TBTF firms compose their debt capital structure.

First, we regress the weighted average maturity of new bond issues on a number of variables. From the first specification reported in Table IV, one can see that the funding advantage is significant and negatively correlated with the maturity, indicating that TBTF institutions prefer short-term financing. This result holds after controlling for the slope of the yield curve, whose coefficient exhibits a negative sign as well, and the weighted average maturity of bonds maturing in the same quarter. As expected, firms are keen to maintain their maturity structure to some extent.

Consistent with our prior observations and the idea of "locking in" current interest rates, the fixed-rate issue volume (and share) is positively related to the maturity of issues. However, the result from an interaction of this volume with a bank dummy indicates that banks are an exception to this rule. A possible interpretation might be that they can afford the luxury of going short term at the expense of higher rollover risk.

In the third specification, we consider the maturity choices of financials of different rating classes (as per their pre-crisis rating). The lower the rating class, the longer the maturity, suggesting that weaker firms try to secure longer-term debt.

[Insert Table IV about here]

In columns (4) through (6), we try to explain the fixed-to-floating mix as defined by the fixed- over the fixed-plus-floating volume at origination. First, we notice that the funding advantage leads banks to issue more fixed-coupon bonds. Second, the steeper the yield curve, the higher the proportion of fixed-rate offerings. Third, there is a strong link between the fix-to-floating mix of maturing bonds and the mix of new issues. Finally, the lower the credit quality, the more fixed-coupon bonds are issued.

To summarize the key findings of this section, we find that financial institutions that are deemed TBTF by the market can afford the luxury to take on short-term fixed-coupon debt in crisis times. This strategy allows them to get around the premium associated with long-term debt in a yield-curve environment reflecting inflation expectations and thus realize substantial savings in funding costs as compared to other companies.

III. Subsidies

Building on the funding advantage estimated in Section I and the data sets on individual bond issues and trades presented in Section II, we next discuss possible approaches to the computation of monetary subsidies financial institutions perceived through better borrowing terms. Then, we explain how benefits accrue to shareholders and debtholders differently and add details on our estimation procedure. Finally, we present our results and identify drivers of the subsidies.

A. Subsidy Methodologies

One can basically distinguish two methodologies to calculate the monetary subsidies from lower borrowing costs.

The first one takes the amount of debt outstanding as the starting point and multiplies it by the rate differential. An underlying assumption is that the entire debt entails periodic interest payments and the resulting product reflects the saving in coupon payments for the existing debt level. The relevant debt outstanding is usually read off the firm's balance sheet.

While the application of the subsidy flow method is straightforward in practice, it has several disadvantages that, depending on the scenario at hand, can lead to over- or underestimations of the fair amount. First, balance sheet positions are stock figures; therefore, the method cannot differentiate when debt was issued and at what conditions. Past debt may have benefited from a larger or smaller TBTF premium. As we have seen in Section I, this premium varies largely over time. The second issue is an imputability problem. The calculation for a given date will take subsidies from past commitments into account while omitting the future benefits of new issues. In other words, the method makes it impossible to impute the total effects associated with new debt to the period when it is issued. Rather, subsidies can at best be recorded as time passes by, which is why we refer to this approach as the "subsidy flow" method.

These calculations can make some sense under two sets of assumptions, the first being that we suppose that the company maintains a stationary debt level by renewing debt immediately as it expires and that the funding advantage remains constant through time. Alternatively, a time-changing spread can be accommodated if the entire unsecured debt of the company is assumed to be short-term (i.e., not longer than a period) and renewed every period. In this manner, the entire funding advantage resulting from new issues can be accounted for in the period under consideration.[5]

The second methodology is immune to the above concerns and initially entails the revaluation of debt in present value terms, either by adjusting the coupon rate or the

[5]Some minor concerns remain: (1) In a fast-changing crisis environment, the quarterly frequency of financial statements is not optimal; (2) no distinction between benefits accruing to shareholders and debtholders is possible, as the share of new issues in current debt is unknown; (3) financial reports data make it difficult to consider the term structure of debt as reports only include minor details on the maturity structure − Schweikhard and Tsesmelidakis (2012) show that the wedge has an inverse term structure; (4) periodic interest payments are assumed, so there is no consideration of zero-coupon bonds for example.

yield-to-maturity spread, and holding everything else equal. The present value obtained is compared to the actual market price and the difference corresponds to the "capitalized subsidy," a number unifying all future advantages. Since these are traced back to their origin, namely the commitment of the firm to the terms of the debt at issuance, the method allows for precise imputation and is thus theoretically sound.

While the general approach is clear, it can be deployed in various ways. If information is limited, the implementation can be based on a set of assumptions, for instance on how large the fraction of new issuance is among the entire outstanding debt. This amount could further be split up into a short- and a long-term portion and the term structure of the funding advantage applied accordingly.

The data at our disposal for this article affords us the opportunity to pursue a more ambitious route, since the comprehensiveness and the level of detail of the *Mergent FISD* database and *TRACE* allow us to take into account the specifics of every bond offering.

B. Effects on Shareholders and Debtholders

We argue that both shareholders and debtholders benefit from implicit guarantees, yet at different stages of the life of a debt.

The equity side capitalizes on better credit terms at the time of issuance. A lower debt interest rate increases the return on equity and hence the value of the equity.

Now, for illustration purposes, consider the example of a plain vanilla bond issue that pays a predetermined coupon of cN annually, where N denotes the notional principal. The arbitrage-free price P of the bond should match its present value, that is

$$P = PV(Bond) = \sum_{t=1}^{T} \frac{cN}{(1+y)^t} + \frac{N}{(1+y)^T}, \tag{8}$$

where T is the maturity and y designates the yield to maturity or internal rate of return. The funding advantage can be thought of as reducing the nominal interest rate $c_G < c_{NG}$, where the subscripts refer to the issuer being implicitly guaranteed (G) or not (NG), while holding y constant, thereby reflecting the lower coupon required by investors in exchange for a given amount of capital. The lower present value $P_{c_G} < P_{c_{NG}}$ can then be interpreted as the firm saving on its future interest payments, with the capitalized subsidies corresponding to $S_c = P_{c_{NG}} - P_{c_G}$. To provide an intuition, the lower interest payments imply a higher residual claim on the part of the shareholders. The calculation supposes that they borrow the amount S_c to make these future amounts available today, that the repayment schedule of the borrowings matches the one of the bond, and that the combined discount rates for the individual cash flows equal the prevailing yield-to-maturity rate of the bond.

The advantage on the debt side stems from the fact that the deterioration of the market value, i.e., the departure of the required from the contracted rate of return, is at least partially offset by the guarantee. Here, the funding advantage manifests in a lower yield $y_G < y_{NG}$, implying that $P_{y_G} > P_{y_{NG}}$. We define this subsidy as $S_y = P_{y_G} - P_{y_{NG}}$. Whether creditors realize this gain or not, it still reflects the damped devaluation of their position.[6]

S_y may also be calculated for shareholders, but the interpretation differs. In this case, S_y corresponds to the additional amount of capital raised holding the repayment and other details of the debt constant.

C. Implementation Details

With the data at hand, we are able to reprice every debt offering as if there was no support, as it includes detailed information on the bond type, the offering and maturity dates, the offering price and volume, the coupon rate and schedule, and in most cases also the effective bond yield. Taking the sum of the price differences for every single bond, we arrive at an estimate of the aggregate value of the government support extended to the financial sector and the effects on the different stakeholders. We retain most bond types, including fixed-, floating-, and zero-coupon bonds, perpetuities, bonds with call or

[6]Our method manipulates the yield-to-maturity bond spread. An alternative would consist in adjusting the zero-volatility spread (Z-spread), which reflects the parallel shift of the risk-free yield curve necessary to match the market price. However, since we focus on the value difference between two bonds that are identical except for the guarantee component, the question of the spread is of marginal importance for our purpose.

put options, and foreign issues.[7] For issues in foreign currency, the values are converted according to contemporaneous market rates.

Our CDS data includes one-, five-, and ten-year maturities, by which we are able to estimate a term structure for the TBTF premium. Linear interpolation allows us to match the maturity of the bond to the right level of the funding advantage.[8] Beyond ten years, the funding advantage is extrapolated but capped to not exceed the ten-year level.

The analysis disregards collateralized debt as well as explicitly guaranteed bond issues like those under the Temporary Liquidity Guarantee Program in October 2008, assuming that both are viewed by the market as perfectly secure.

We attribute the issues of subsidiaries to their parents as we assume the parent company would step in in event of distress, at least for reputational reasons.

Our data on subordinated CDSs is scarce, which is why we do not estimate a separate funding advantage for the junior-debt case but rather extend the senior-debt results to subordinated tranches. As these must benefit even more from the guarantees, at worst we underestimate the subsidies they entail.

For simplicity, we ignore the effects of call and put options since, if at all, they are components of both the guaranteed and the revalued bond, and value differences due to the options should be negligible for our purposes. Finally, convertible debt is left out of the analysis.

[Insert Table V and Figures 7 and 8 about here]

D. Results for Shareholders' Subsidies

Deploying the pricing machinery to our subsample of bond issues from January 2007 to September 2010, we obtain S_c and S_y on an individual-issue level, multiply them by each offering's volume, and present aggregate results in Panels A and B of Table V, respectively.

[7] Floating-rate bonds are priced using the well-known backward induction scheme that entails discounting the cum-coupon value of the bond at the first refixation date.

[8] Unreported results using a cubic spline instead of a linear interpolation/extrapolation scheme turn out to be very similar.

The results for both types of adjustments are similar. The lowering of the coupon rate in Panel A reflects actual savings for the shareholders and given a total of \$129.2bn for the four-year period surrounding the crisis, it is substantial. In line with expectations, the bulk of the subsidies arise in the years 2008 and 2009, and banks' contribution amounts to 93.9% of the company sample. For the four subsectors, Figure 7 relates the quarterly subsidies to the volumes of the corresponding issues and shows their evolution. Accordingly, shareholders benefited most from bond issues between the fourth quarter of 2008 and the second quarter of 2009. This is not surprising since this is the period after the announcement of several rescue programs and market expectations of TBTF can be assumed to have peaked then.

The lowering of the yield in Panel B reflects how much more debt a TBTF institution can raise for given credit terms compared to a non-guaranteed firm. The grand total amounts to \$98bn and the distribution over the cross-section and over time (Figure 8) is similar to the main case.

E. Results for Debtholders' Subsidies

Whereas the subsidies in the primary market are calculated based on the funding advantage prevailing at the offering date of a given bond, the latent benefits to debtholders change through time and require the use of the *TRACE* transaction data that we merge with the issue information from *Mergent FISD*. These are necessary to determine the price of the bond at any point in time. For each reference entity, we select the day with the largest funding advantage, which typically lies around the turn of year 2008/2009.

We note that contrary to the primary market case, the secondary-market estimations are not only based on issues of 2007 and later, but on all actively traded issues of the parents and their subsidiaries in that period.

For the results in Table V, Panel C, the S_y of a bond is scaled by its offering volume and aggregated. Then, to avoid double-counting, for each issue, we subtract any primary market subsidy, if there is. We refer to these results as the incremental secondary market subsidies. They amount to \$236bn in total. Compared to Panels A and B, some mass shifts from 2009 to 2008 and no subsidies at all are recorded for 2010. This can be explained by the relatively high issue volumes in 2008 as compared to the later period (cf. Figure 2).

In Panel D, we sum over the lower-coupon-rate-implied primary market subsidies (Panel A) and the incremental secondary market subsidies (Panel C) to obtain an estimate of the overall effects of $365.2bn.

Finally, we compute time-series of "continuous" secondary-market subsidies, for which we combine contemporaneous values for the funding advantage with the day-matched trading volume as inferred from *TRACE* data. The trading volume replaces the issue volume of the previous calculations and this different perspective gives an impression of the actual impact through time. The averaged series for financials and the banks subgroup are plotted in Figure 9, both in absolute and relative terms. The highest value reached is $2.85bn on January 23, 2009. It seems small compared to the magnitude of the numbers in Table V, Panel C, however it holds for just a single day, whereas the other values are aggregates assuming the entire volume of an issue is turned over exactly once. To obtain a figure of comparable size, one would need to compute the integral of the subsidies in Figure 9. Then again, it would be impossible to take care of double counting, albeit if the same position changes hands several times it seems redundant to record it more than once. In summary, the results based on issue volume are well-suited for a cross-sectional or an aggregate appreciation, whereas the trading-related metric lends itself to time-series and panel analyses.

F. Determinants of Subsidies

The panel data set emerging from our previous computations affords us the opportunity to relate the subsidies to a number of potential determinants.

Similar to Schweikhard and Tsesmelidakis (2012), we consider the following variables also summarized in Table VI:

- ◇ The implied-volatility index VIX as a proxy unifying both the state of the economy and illiquidity

- ⋄ The contemporaneous S&P issuer ratings
- ⋄ The log-return of the stock price as an indicator of firm performance
- ⋄ The total assets as a TBTF proxy
- ⋄ A default correlation proxy β_{rs}^{DF} calculated over a 50-day rolling window as the contemporaneous covariance between the daily stock return and the daily return of the S&P 500 Diversified Financials index, divided by the variance of the index return
- ⋄ The Marginal Expected Shortfall (*MES*) systemic risk measure by Acharya et al. (2010b)
- ⋄ The admission of a company under the Troubled Asset Relief Program (TARP) program is accounted for by a dummy variable (*TARP*) and the funds received in billions of US$ (*TARP Amounts*)

We run a series of pooled regressions. In doing so, we cluster residuals on the firm level following the recommendations in Petersen (2009) to avoid inflated t-statistics due to correlations among the residuals.

The VIX is significantly positive, indicating that the implicit subsidies are likely to be relevant in crisis periods. The subsidies are more pronounced for A- and AA-rated firms and decline the lower the rating class. The coefficient of the daily stock returns is negative.

On the TBTF front, size, *MES*, default correlation, and the extent of TARP support are significant, positive drivers of the subsidies, both alone and in combination. The explanatory power of the model specifications is fairly high, reaching an adjusted R^2 of 0.345 in column (8).

In summary, these results provide overwhelming support for the subsidy metric at hand as it is well explained by a set of intuitive variables. The explanatory power surpasses the one in the regressions of the relative model-to-market deviations on a similar set of variables conducted in Schweikhard and Tsesmelidakis (2012).

[Insert Tables VI and VII, and Figure 9 about here]

IV. Concluding Remarks

In this paper, we combine the structural-model-based methodology for the estimation of the TBTF premium introduced in Schweikhard and Tsesmelidakis (2012) with a rich set of bond issue and transaction data to obtain estimates of the aggregated subsidies implicitly extended to the financial sector in the years 2007-2010.

We differentiate the benefits accrued to shareholders at issuance, \$129.2bn, from the benefits to debtholders, \$236.1bn. The grand total of \$365.2bn is remarkable but probably only part of the truth, since these results are based on bond issues that on average account for 30% of the outstanding debt. In fact, they disregard other forms of debt financing like interbank borrowing, which according to the aggregate balance sheet for U.S. commercial banks released weekly by the Fed amount to about 22% of total borrowings in 2008/2009. Therefore, as a rough guess, the actual subsidies could be about twice as high as estimated here.

The data set also allows for a number of intriguing observations on the ways banks changed their financing strategy in the course of the crisis. Our results suggest that they deliberately took advantage of their privileged status and had a preference for short-term fixed-rate debt contrary to the usual behavior of non-guaranteed firms to subscribe to long-term debt in such uncertain circumstances. Further research is required to fully understand these stylized facts.

A. Appendix

This table gives an overview of the sample constituents classified as financial companies according to GICS and provides individual details on the subsector, the participation in the TARP program, and on the number of observations after merging stock, option, balance sheet and CDS data sets. The subsector classification is based on GICS with a few major banks having been reassigned from "Diversified Financials" to "Banks." The remaining companies in the former group form a new group labeled "Others." A list of the 424 nonfinancial companies in our sample is not printed here to conserve space but available upon request.

No.	Subsector	Company	TARP	Observations
1	Banks	American Express Co	yes	2,099
2	Banks	BB&T Corp	yes	732
3	Banks	Bank of America Corp	yes	1,170
4	Banks	Bear Stearns Companies Inc	no	1,568
5	Banks	CIT Group Inc	yes	1,783
6	Banks	Capital One Financial Corp	yes	2,008
7	Banks	Citigroup Inc	yes	2,082
8	Banks	Countrywide Financial Corp	no	1,381
9	Banks	Goldman Sachs Group Inc	yes	2,132
10	Banks	JPMorgan Chase & Co	yes	1,537
11	Banks	Keycorp	yes	1,271
12	Banks	Lehman Brothers Holdings Inc	no	1,622
13	Banks	MGIC Investment Corp	no	1,806
14	Banks	Marshall & Ilsley Corp	yes	396
15	Banks	Merrill Lynch & Co Inc	no	1,714
16	Banks	Morgan Stanley	yes	2,147
17	Banks	National City Corp	no	484
18	Banks	PMI Group Inc	no	1,852
19	Banks	PNC Financial Services Group Inc	yes	833
20	Banks	Radian Group Inc	no	1,933
21	Banks	SLM Corp	no	1,794
22	Banks	Charles Schwab Corp	no	1,815
23	Banks	SunTrust Banks Inc	yes	1,040
24	Banks	U.S. Bancorp	yes	1,499
25	Banks	Wachovia Corp	no	1,594
26	Banks	Washington Mutual Inc	no	1,493
27	Banks	Wells Fargo & Co	yes	2,006
28	Insurance	AFLAC Inc	no	713
29	Insurance	Allstate Corp	no	1,945
30	Insurance	Ambac Financial Group Inc	no	1,561
31	Insurance	American Financial Group Inc	no	1,817
32	Insurance	American International Group Inc	yes	2,056
33	Insurance	Aon Corp	no	2,008
34	Insurance	Assurant Inc	no	1,199

Continued

No.	Subsector	Company	TARP	Observations
35	Insurance	WR BERKLEY Corp	no	1,110
36	Insurance	CNA Financial Corp	no	2,010
37	Insurance	Chubb Corp	no	2,052
38	Insurance	Genworth Finl Inc	no	1,463
39	Insurance	Hartford Financial Services Group Inc	yes	2,027
40	Insurance	Lincoln National Corp	yes	1,774
41	Insurance	Loews Corp	no	1,937
42	Insurance	MBIA Inc	no	2,004
43	Insurance	Marsh & Mclennan Companies Inc	no	1,619
44	Insurance	MetLife Inc	no	2,045
45	Insurance	Nationwide Financial Services	no	444
46	Insurance	Odyssey Re Holdings Corp	no	719
47	Insurance	Principal Financial Group Inc	no	1,037
48	Insurance	Progressive Corp	no	1,181
49	Insurance	Prudential Financial Inc	no	1,880
50	Insurance	SAFECO Corp	no	1,506
51	Insurance	Torchmark Corp	no	1,205
52	Real Estate	Avalon Bay Communities Inc	no	1,839
53	Real Estate	BRE Properties Inc	no	1,457
54	Real Estate	Boston Properties Inc	no	1,465
55	Real Estate	Developers Diversified Realty Corp	no	1,487
56	Real Estate	Duke Realty Corp	no	1,085
57	Real Estate	Felcor Lodging Trust Inc	no	670
58	Real Estate	Health Care REIT Inc	no	987
59	Real Estate	Hospitality Properties Trust	no	1,341
60	Real Estate	Host Hotels & Resorts Inc	no	1,006
61	Real Estate	Istar Financial Inc	no	1,576
62	Real Estate	Kimco Realty Corp	no	1,787
63	Real Estate	Liberty Properties Trust	no	345
64	Real Estate	MACK CALI Realty Corp	no	1,166
65	Real Estate	ProLogis	no	1,736
66	Real Estate	Rayonier Inc	no	718
67	Real Estate	Simon Properties Group Inc	no	1,850
68	Real Estate	Vornado Realty Trust	no	1,464
69	Real Estate	Weingarten Realty Investors	no	887
70	Others	Franklin Resources Inc	no	1,507
71	Others	Janus Cap Group Inc	no	1,526
72	Others	Legg Mason Inc	no	1,373
73	Others	PHH Corp	no	1,304
74	Others	State Street Corp	yes	769

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Table I: Summary Statistics of Firms

This table breaks down our company sample across financial subsectors and issuer rating classes, as well as across the time dimension. Averages are presented for the number of firms (*Firms*) total assets (*TA*), total liabilities (*TL*), market capitalization (*MC*), and earnings-per-share (*EPS*). Monetary amounts are in billions of US$. The pre-crisis period ranges from January 2006 to July 2007, the crisis period from August 2007 to September 2009, and the post-crisis period covers October 2009 to December 2010.

	Pre-Crisis Period					**Crisis Period**					**Post-Crisis Period**				
	Firms	TA	TL	MC	EPS	Firms	TA	TL	MC	EPS	Firms	TA	TL	MC	EPS
Sectors															
Banks	27.0	409.34	380.03	56.82	1.42	23.7	506.35	469	36.51	-0.43	19.1	570.39	518.90	46.70	0.36
Insurance	24.0	139.28	125.58	22.67	2.30	23.2	147.29	134.86	13.80	-3.54	20.9	156.08	140.20	11.04	-0.02
Real Estate	18.0	7.72	4.73	7.51	0.67	18.0	9.41	6.05	5.29	0.37	18.0	9.29	5.64	5.92	0.12
Others	5.0	27.79	23.03	13.62	0.89	5.0	39.14	33.50	11.03	-0.13	5.0	38.36	32.11	10.68	0.54
Financials	74	198.28	182.09	30.83		74	237.45	218.60	19.83		65	233.86	211.15	20.57	
Ratings															
AA	12.0	712.82	656.09	105.56	3.53	11.3	904.42	836.2	64.82	-8.28	9.9	988.66	897.95	72.44	-0.79
A	36.0	158.09	146.66	22.66	1.34	33.1	154.79	143.14	14.23	-0.08	29.1	146	132.37	14.94	0.42
BBB	24.0	17.13	12.96	7.75	0.82	23.5	19.86	15.19	5.42	0.41	22.1	21.53	16.48	5.54	0.35
BB	2.0	6.73	3.88	6.34	-0.04	2.0	7.27	3.93	3.75	-0.01	2.0	7.36	3.87	4.64	-0.35
Total	74	198.24	182.05	30.83		74	228.60	210.27	19.29		65	227.33	205.19	20.14	

Table II: Differences Between Model and Market Credit Spreads

This table summarizes the baseline (constant default barrier) estimations as in Schweikhard and Tsesmelidakis (2012) of model-implied and guarantee-free CDS prices and compares them to their actual market counterparts. We report means and standard deviations (*Std*) for CDS market and model spreads as well as their deviations (*Dev*). The table does not reflect any adjustment for counterparty risk. The pre-crisis period ranges from January 2002 to July 2007, the crisis period ranges from August 2007 to September 2009, and the post-crisis period follows until September 2010. All spreads are denoted in basis points per annum.

	Pre-Crisis Period						**Crisis Period**						**Post-Crisis Period**					
	Mean			**Std**			**Mean**			**Std**			**Mean**			**Std**		
	Market	Model	Dev	Market	Model	Dev	Market	Model	Dev	Market	Model	Dev	Market	Model	Dev	Market	Model	Dev
Sectors																		
Banks	41.61	35.91	-5.70	49.58	52.79	24.92	393.27	743.73	350.46	528.47	749.96	456.17	341.73	579.20	237.47	466.62	660.69	333.18
Insurance	47.20	40.07	-7.12	52.35	52.09	25.58	308.88	442.53	133.65	510.58	606.30	332.40	333.15	370.25	37.10	802.46	583.39	695.26
Real Estate	54.22	46.72	-7.50	42.13	48.01	34.50	549.43	613.18	63.75	804.93	695.49	414.18	301.58	473.70	172.12	371.40	622.55	281.46
Others	35.96	23.53	-12.44	23.05	33.63	26.41	332.30	347.96	15.66	587.96	381.91	462.66	259.84	139.11	-120.73	196.64	96.37	164.85
Financials	45.42	38.53	-6.89	48.51	51.10	27.17	400.16	583.48	183.32	615.62	685.32	426.12	321.69	447.52	125.83	572.43	611.75	483.53

Table III: Summary Statistics of Bond Issues and Trades

This table breaks down our sample of bond issues and trades across financial subsectors (Panel A) and ratings (Panel B), as well as across three periods of equal length. We present total offering amounts, average times to maturity, and volume-weighted times to maturity for fixed-coupon (FCB), variable-coupon (VCB), and zero-coupon (ZCB) bonds, as well as the offering amounts outstanding relative to the total debt ($\frac{OAO}{TD}$). Furthermore, we report trading volumes for different maturities and the total number of trades (TT). Monetary amounts are in billions of US$. For this table, rating classification is based on the S&P issuer ratings effective May 31, 2007. The pre-crisis period is from June 2005 to July 2007, the crisis period ranges from August 2007 to September 2009, and the post-crisis period lasts until November 2011.

Panel A

		Offering Amounts					Maturities				Weighted Maturities				Trading Volumes				
	Issues	**FCB**	**VCB**	**ZCB**	$\sum$	$\frac{OAO}{TD}$	**FCB**	**VCB**	**ZCB**	∅	**FCB**	**VCB**	**ZCB**	∅	$V_{T\leq 5y}$	$V_{5y<T\leq 10y}$	$V_{T>10y}$	$V_{\sum}$	**TT**
											Pre-Crisis Period								
Sectors																			
Banks	4,587	213.41	545.90	34.81	794.13	0.28	7.99	5.51	2.34	5.41	14.55	5.64	3.36	7.93	148.21	369.77	901.52	1,419.51	3,104
Insurance	1,292	50.02	63.09	0.12	113.22	0.56	8.71	9.44	14.96	8.87	12.10	16.32	9.52	14.45	94.20	132.82	220.86	447.88	2,613
Real Estate	91	35.10	2.46	0.00	37.56	0.70	11.12	6.84	0.00	10.70	12.48	3.83	0.00	11.91	5.50	36.17	104.62	146.29	151
Others	8	1.88	1.25	0.00	3.12	0.11	8.04	28.38	0.00	15.66	8.50	47.47	0.00	24.09	0.00	0.00	17.00	17.00	9
Financials	5,978	300.40	612.70	34.93	948.03	0.30	8.35	6.10	2.39	6.25	13.86	6.82	3.38	8.92	247.91	538.76	1,244.00	2,030.68	5,877
											Crisis Period								
Sectors																			
Banks	5,513	517.45	255.01	45.06	817.53	0.29	2.50	8.54	2.17	2.96	5.77	4.78	2.58	5.28	692.97	312.51	425.76	1,431.24	2,923
Insurance	761	46.03	35.51	0.61	82.15	0.47	7.80	12.30	5.88	8.27	9.64	26.44	12.20	16.92	13.12	56.14	133.50	202.75	999
Real Estate	34	13.57	0.80	0.00	14.37	0.73	9.44	4.98	0.00	9.30	10.01	4.98	0.00	9.73	0.00	12.26	15.31	27.56	390
Others	12	7.34	1.95	0.00	9.29	0.15	4.38	2.50	0.00	4.21	4.49	1.86	0.00	3.94	14.32	4.50	5.00	23.82	28
Financials	6,320	584.39	293.27	45.68	923.34	0.30	3.66	9.02	2.18	3.64	6.16	7.38	2.71	6.37	720.40	385.41	579.57	1,685.37	4,340
											Post-Crisis Period								
Sectors																			
Banks	5,078	177.11	60.05	30.22	267.38	0.28	2.87	14.51	2.17	4.83	8.14	11.17	1.99	8.12	1,061.56	3,459.59	3,794.43	8,315.57	6,3375
Insurance	71	39.80	5.60	0.00	45.40	0.61	11.21	2.07	0.00	10.18	9.24	1.98	0.00	8.34	45.28	146.86	718.05	910.18	1104
Real Estate	47	21.99	0.00	0.00	21.99	0.76	10.33	0.00	0.00	10.33	9.81	0.00	0.00	9.81	0.00	276.25	363.08	639.32	690
Others	10	4.10	0.25	0.00	4.35	0.26	6.07	3.01	0.00	5.77	6.45	3.01		6.25	3.75	39.51	35.70	78.96	88
Financials	5,206	243.00	65.90	30.22	339.12	0.30	3.35	14.40	2.17	4.95	8.44	10.36	1.99	8.24	1,110.59	3,922.20	4,911.26	9,944.03	65,257

Table III — *Continued*

Panel B

		Offering Amounts					Maturities				Weighted Maturities				Trading Volumes				
	Issues	**FCB**	**VCB**	**ZCB**	$\sum$	$\frac{OAO}{TD}$	**FCB**	**VCB**	**ZCB**	∅	**FCB**	**VCB**	**ZCB**	∅	$V_{T\leq 5}$	$V_{5<T\leq 10}$	$V_{T>10}$	$V_{\sum_M}$	**TT**
Pre-Crisis Period																			
Ratings																			
AA	3,161	140.79	353.39	24.52	518.70	0.32	7.58	5.30	2.39	5.13	16.32	6.30	2.84	8.86	98.16	197.23	380.46	675.85	1,648
A	2,737	130.85	254.50	10.40	395.75	0.25	8.75	7.03	2.40	7.40	11.50	7.40	4.65	8.68	144.26	319.86	744.05	1,208.16	4,098
BBB	75	27.17	4.38	0.00	31.54	0.53	12.04	14.81	0.00	12.46	12.53	14.89	0.00	12.86	5.50	21.67	119.50	146.67	131
BB	5	1.60	0.43	0.00	2.03	0.88	11.97	4.89	0.00	9.14	12.48	4.89	0.00	10.87	0.00	0.00	0.00	0.00	0
Totals	5,978	300.40	612.70	34.93	948.03	0.30	8.35	6.10	2.39	6.25	13.86	6.82	3.38	8.92	247.91	538.76	1,244.01	2,030.68	5,877
Crisis Period																			
Ratings																			
AA	4,304	408.89	221.26	38.28	668.43	0.27	2.18	7.43	2.07	2.58	5.19	6.53	2.19	5.46	570.13	223.34	274.62	1,068.09	2,091
A	1,976	156.53	71.21	7.40	235.15	0.37	6.68	11.08	2.46	5.84	8.13	10.06	5.40	8.63	150.28	148.06	273.72	572.05	1,889
BBB	38	17.93	0.80	0.00	18.73	0.60	9.73	4.98	0.00	9.60	11.01	4.98	0.00	10.75	0.00	14.01	31.23	45.23	360
BB	2	1.04	0.00	0.00	1.04	0.61	6.53	0.00	0.00	6.53	6.19	0.00	0.00	6.19	0.00	0.00	0.00	0.00	0
Totals	6,320	584.39	293.27	45.68	923.34	0.30	3.66	9.02	2.18	3.64	6.16	7.38	2.71	6.37	720.40	385.41	579.57	1,685.37	4,340
Post-Crisis Period																			
Ratings																			
AA	4,214	117.59	42.41	26.89	186.90	0.28	2.81	15.59	2.08	4.58	8.76	12.23	1.95	8.57	596.67	2,283.55	2,723.04	5,603.26	50,061
A	940	102.61	23.24	3.33	129.18	0.38	5.75	11.76	2.59	6.29	7.70	7.01	2.32	7.44	507.42	1,384.24	1,695.14	3,586.80	14,350
BBB	43	18.63	0.25	0.00	18.88	0.50	11.22	3.00	0.00	11.02	10.42	3.00	0.00	10.32	6.50	237.00	491.82	735.32	817
BB	9	4.16	0.00	0.00	4.16	0.76	9.45	0.00	0.00	9.45	8.96	0.00	0.00	8.96	0.00	17.40	1.25	18.65	29
Totals	5,206	243.00	65.90	30.22	339.12	0.30	3.35	14.40	2.17	4.95	8.44	10.36	1.99	8.24	1,110.59	3,922.20	4,911.25	9,944.03	65,257

Table IV: Determinants of the Bond Structure

This table summarizes the results of a series of pooled ordinary least squares regressions of the volume-weighted average years-to-maturity T_{issue} (columns 1 to 3) and the share of fixed-coupon issue volume $\frac{V_{fix}}{V_{fix}+V_{flo}}$ (columns 4 to 6) on a number of explanatory variables defined as follows: T_{mat} is the weighted average remaining life of maturing securities; V_{fix} and V_{flo} are the volumes in billions of US$ of fixed-rate and floating-rate bonds issued on a given date, respectively, and V_{fix}^{mat} and V_{flo}^{mat} correspond to the volumes of bonds maturing; the term spread is the difference between ten-year and three-month Treasury spot rates; the funding advantage is the estimated 5-year yield spread differential in percentage points from which government-backed firms benefit; issuer ratings are included as dummies. The observations underlying the estimations range from March 2002 to June 2010, except in specification (2) where we use a subset starting in 2007, and are aggregated to a quarterly frequency, with volumes being summed and other variables averaged. Next to average coefficients, we indicate t-statistics based on heteroskedasticity-robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	T_{issue}						$\frac{V_{fix}}{V_{fix}+V_{flo}}$					
	(1)		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
T_{mat}	0.362	2.84 ***	0.298	1.99 **	0.253	2.25 **						
T_{issue}							0.006	3.41 ***	0.006	3.39 ***	0.01	2.72 ***
V_{fix}			1.511	2.26 **								
$\frac{V_{fix}}{V_{fix}+V_{flo}}$	3.563	3.25 ***			2.367	2.63 ***						
$\frac{V_{fix}^{mat}}{V_{fix}^{mat}+V_{flo}^{mat}}$							0.253	7.85 ***	0.251	7.92 ***	0.16	5.04 ***
Term Spread	-0.826	-3.32 ***	-0.342	-1.07			0.059	6.38 ***	0.057	6.28 ***	0.06	6.73 ***
Funding Adv.	-0.172	-1.93 *	-0.244	-2.05 **			0.027	4.71 ***	0.025	4.87 ***	0.03	5.28 ***
Bank Dummy					-1.564	-2.04 **					-0.11	-4.25 ***
Crisis Dummy									0.206	5.65 ***		
Post-crisis Dummy									0.212	2.48 **		
$V_{fix}\times$ Bank Dummy			-1.732	-2.68 ***								
AA					3.880	2.71 ***						
A					4.178	3.03 ***					0.10	4.02 ***
BBB					4.212	2.76 ***					0.31	8.97 ***
Constant	5.854	9.11 ***	8.199	7.20 ***	2.330	1.42	0.296	10.91 ***	0.279	10.31 ***	0.36	9.77 ***
Observations	636		245		773		636		636		636	
$Adj.R^2$	0.062		0.056		0.046		0.197		0.231		0.29	
Coef. Estimates	OLS		OLS		OLS		OLS		OLS		OLS	
Standard Errors	robust		robust		robust		robust		robust		robust	

Table V: Capitalized Subsidies in the Bond Market

Panel A reflects the higher funding costs assuming adjusted (guarantee-free) coupon rates. On the other hand, Panel B reflects, ceteris paribus, the aggregate shortage in raised debt under the adjusted (guarantee-free) yield-to-maturity for new debt issues. For Panel C, secondary market results are estimated and any primary market subsidies are deducted on the issue level to avoid double-counting. Panel D presents the sum over yield-based primary and secondary market subsidies (Panel A and C). The underlying sample ends in September 2010. All values are in billions of US$.

Panel A – Primary Market Subsidies Implied by a Lower Coupon Rate

	2007	2008	2009	2010	*Total*
Banks	3.31	38.25	77.15	2.58	121.29
Insurance	0.17	1.76	1.44	2.05	5.42
Real Estate	0.14	0.11	0.83	0.24	1.32
Others	0.00	0.27	0.86	0.01	1.14
Total	3.62	40.39	80.28	4.88	129.17

Panel B – Primary Market Subsidies Implied by a Lower Yield

	2007	2008	2009	2010	*Total*
Banks	3.06	31.28	54.72	2.49	91.55
Insurance	0.14	1.56	1.28	1.32	4.30
Real Estate	0.14	0.10	0.74	0.23	1.21
Others	0.00	0.21	0.76	0.01	0.98
Total	3.34	33.15	57.50	4.05	98.04

Panel C – Secondary Market Subsidies Implied by a Lower Yield

	2007	2008	2009	2010	*Total*
Banks	0.47	93.34	109.13	0.00	202.94
Insurance	0.04	6.13	19.56	0.00	25.73
Real Estate	0.01	3.71	2.89	0.00	6.61
Others	0.00	0.27	0.51	0.00	0.78
Total	0.52	103.45	132.09	0.00	236.06

Panel D – Overall Subsidies Implied by a Lower Yield

	2007	2008	2009	2010	*Total*
Banks	3.78	131.59	186.28	2.58	324.23
Insurance	0.21	7.90	21.00	2.05	31.16
Real Estate	0.16	3.82	3.71	0.24	7.93
Others	0.00	0.54	1.36	0.01	1.91
Total	4.15	143.85	212.35	4.88	365.23

Table VI: Summary Statistics of Subsidy Determinants

This table breaks down the mean, standard deviation (*Std*), minimum (*Min*) and maximum (*Max*) statistics for possible determinants of secondary market subsidies into the three main periods of the sample, with the crisis period ranging from August 2007 to September 2009. The term spread is the difference between ten-year and three-month Treasury spot rates. The stock return is the daily log return. Calculated over a 50-day rolling window, $\beta_{r_S}^{DF}$ is the contemporaneous covariance between the daily stock return and the daily return of the S&P 500 Diversified Financials index, divided by the variance of the index return. *MES* is the Marginal Expected Shortfall systemic risk measure as presented in Acharya et al. (2010b). *Tarp Amounts* is a time-invariant variable reflecting funds in billions of US$ received by a company under the TARP program. The plus and minus signs represent theoretical predictions of the effects of each variable on received subsidies.

		Pre-Crisis				**Crisis**				**Post-Crisis**			
		Mean	**Std**	**Min**	**Max**	**Mean**	**Std**	**Min**	**Max**	**Mean**	**Std**	**Min**	**Max**
Macrofinancial Variables													
VIX	+	13.007	2.463	9.970	24.170	27.097	10.065	16.300	80.860	23.834	5.804	15.580	45.790
Firmspecific Variables													
Ratings													
S&P Issuer Ratings	+												
Firm Condition													
Stock Return r_S (%)	−	-0.001	1.338	-18.928	13.757	0.006	6.074	-73.166	70.487	-0.082	2.928	-31.016	24.536
Size													
Total Assets (bn)	+	0.223	0.378	0.002	2.221	0.254	0.476	0.002	2.358	0.252	0.510	0.002	2.364
Systemic Risk													
$\beta_{r_S}^{DF}$	+	0.775	0.338	-0.111	3.041	0.943	0.438	-0.115	3.701	0.999	0.399	0.024	3.204
MES	+	0.025	0.012	-0.078	0.108	0.047	0.036	-0.001	0.808	0.033	0.013	0.006	0.114
Government Support													
TARP Amounts	+												

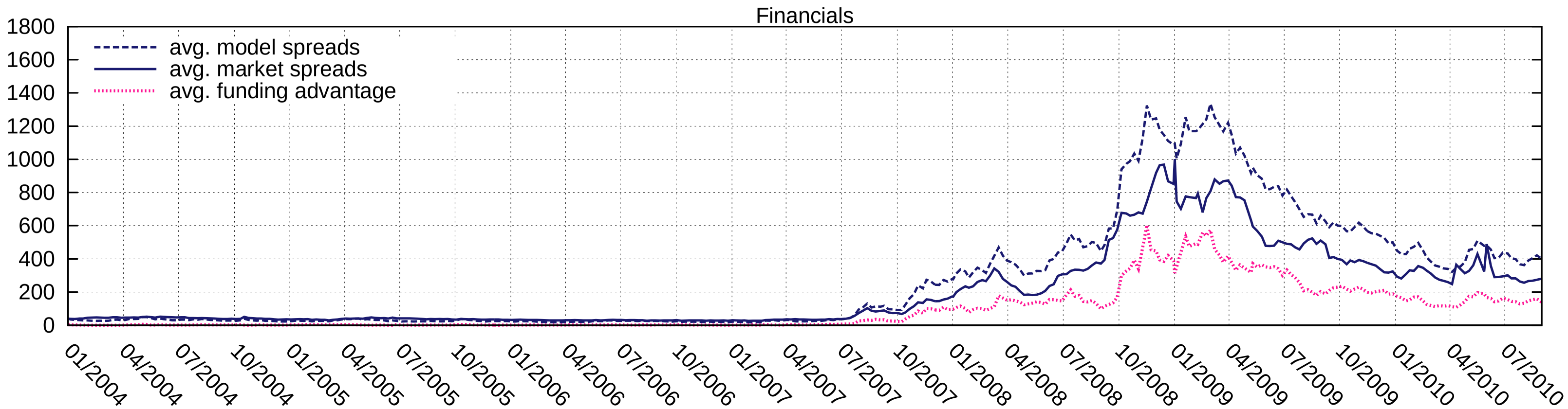
Table VII: Determinants of Secondary Market Subsidies

This table summarizes the results of a series of pooled ordinary least squares regressions of secondary market subsidies calculated continuously using actual trading volumes for 74 U.S. financial firms. The underlying daily observations cover the period from March 2002 through September 2010. The *VIX* index reflects the implied volatility of the S&P 500 index. The rating dummies are issuer ratings as of May 2007. The term spread is the difference between ten-year and three-month Treasury spot rates. The stock return r_S is a daily log return. Size is measured by the book value of total assets. Based on a 50-day rolling window, $\beta_{r_S}^{DF}$ is the contemporaneous covariance between the daily stock return and the daily return of the S&P 500 Diversified Financials index, divided by the variance of the index return. *MES* is the Marginal Expected Shortfall systemic risk measure presented in Acharya et al. (2010b). The *TARP* dummy reflects participation of a company in that program and *Tarp Amounts* the extent of support in billions of US$. Next to average coefficients, we indicate *t*-statistics based on clustered standard errors that adjust for firm effects (*CL-F*). Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Coef.	*t*	Coef.	*t*	Coef.	*t*	Coef.	*t*	Coef.	*t*	Coef.	*t*
VIX	0.190	3.27 ***	0.196	3.23 ***	0.180	3.19 ***	0.137	2.41 **	0.130	2.59 **	0.126	2.48 **
Rating (AA)			12.743	3.11 ***	12.613	3.09 ***	9.807	2.81 ***				
Rating (A)			1.540	3.00 ***	1.767	3.81 ***	-0.446	-0.54				
Rating (BBB)			0.458	1.22	1.565	2.75 ***						
r_S	-1.343	-0.85	-1.196	-0.72	-1.763	-1.06	-6.871	-2.19 **	-6.501	-2.51 **	-6.100	-2.65 **
Size	12.116	5.39 ***							11.230	5.64 ***	2.824	2.61 **
$\beta_{r_S}^{DF}$					4.002	2.47 **						
MES							144.255	3.37 ***	133.754	3.70 ***	137.554	3.91 ***
TARP									0.466	0.28		
TARP Amounts											0.414	7.80 ***
Constant	-5.172	-3.14 ***	-5.091	-3.12 ***	-8.953	-3.18 ***	-7.442	-3.30 ***	-9.319	-3.62 ***	-8.739	-3.44 ***
Observations	34143		34273		34273		23937		23835		23835	
$Adj.R^2$	0.221		0.138		0.151		0.199		0.274		0.345	
Coef. Estimates	OLS		OLS		OLS		OLS		OLS		OLS	
Standard Errors	CL-F		CL-F		CL-F		CL-F		CL-F		CL-F	

Figure 1: Funding Advantage Implied by Government Guarantees

These charts show the evolution of average model-implied and guarantee-free spreads, their actual market counterparts, and the resulting implicit funding advantage that corresponds to the difference between the two but also adjusts for counterparty risk. The graphs are based on our sample of U.S. financial firms. All numbers are in basis points per annum.



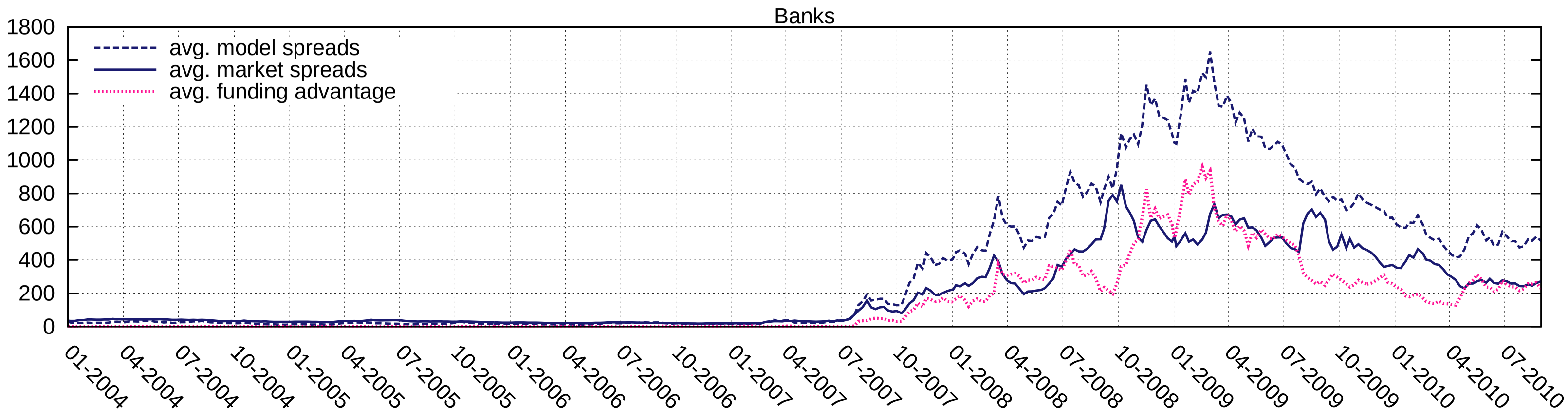


Figure 2: Bond Issues

This chart depicts the evolution of bond issues in the broader financial sector and the bank subsector, both in terms of issue volumes in billions of US$ and numbers, for the period January 2004 to September 2010.

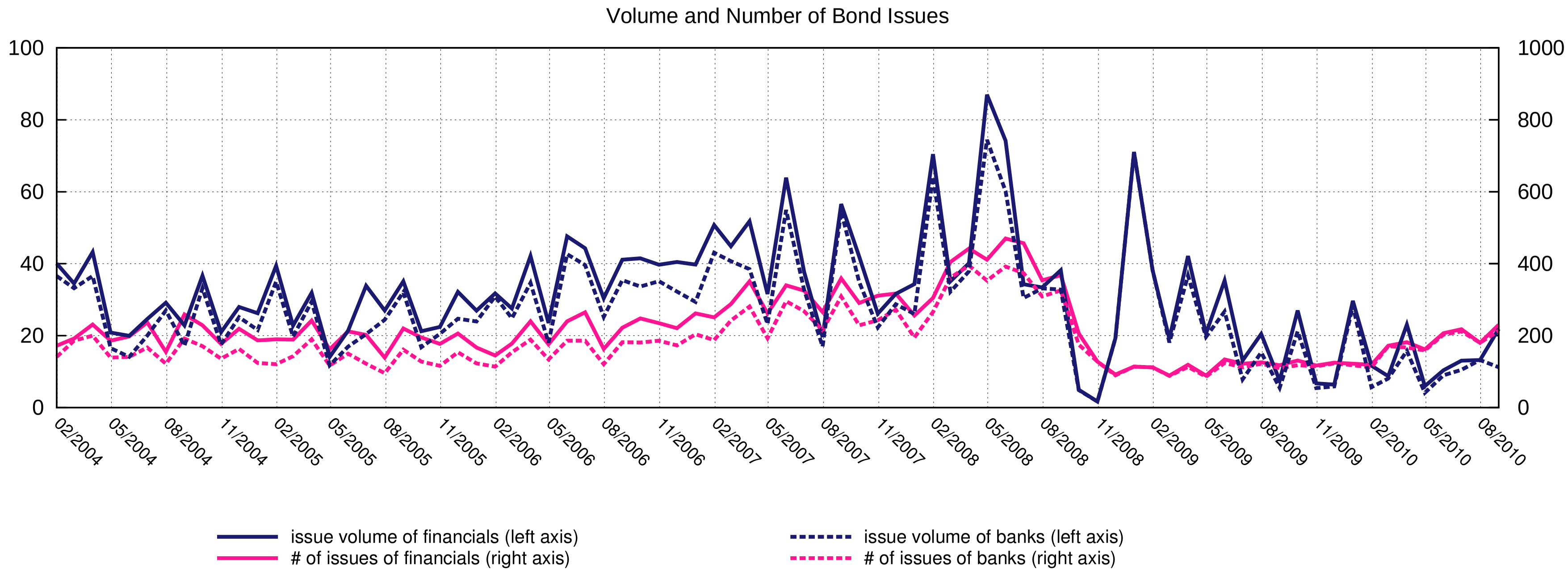


Figure 3: Fixed-Rate vs. Floating-Rate Issuance

This chart depicts the evolution of the fixed-rate to floating-rate breakdown of new bond issues in percent for the U.S. banking sector from 2002 to 2010.

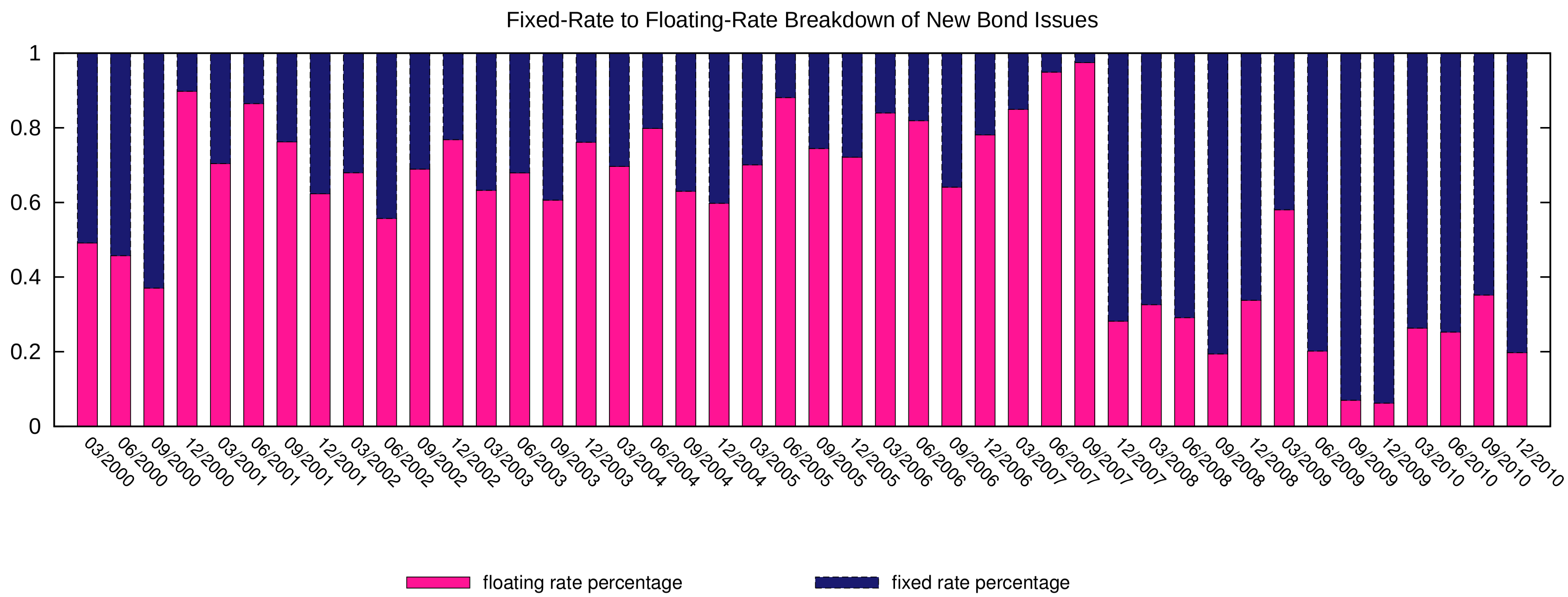


Figure 4: Average Maturity of Bond Issues by Banks

This chart depicts the evolution of the volume-weighted average maturity of bank bond issues in percent from 2002 to 2010.

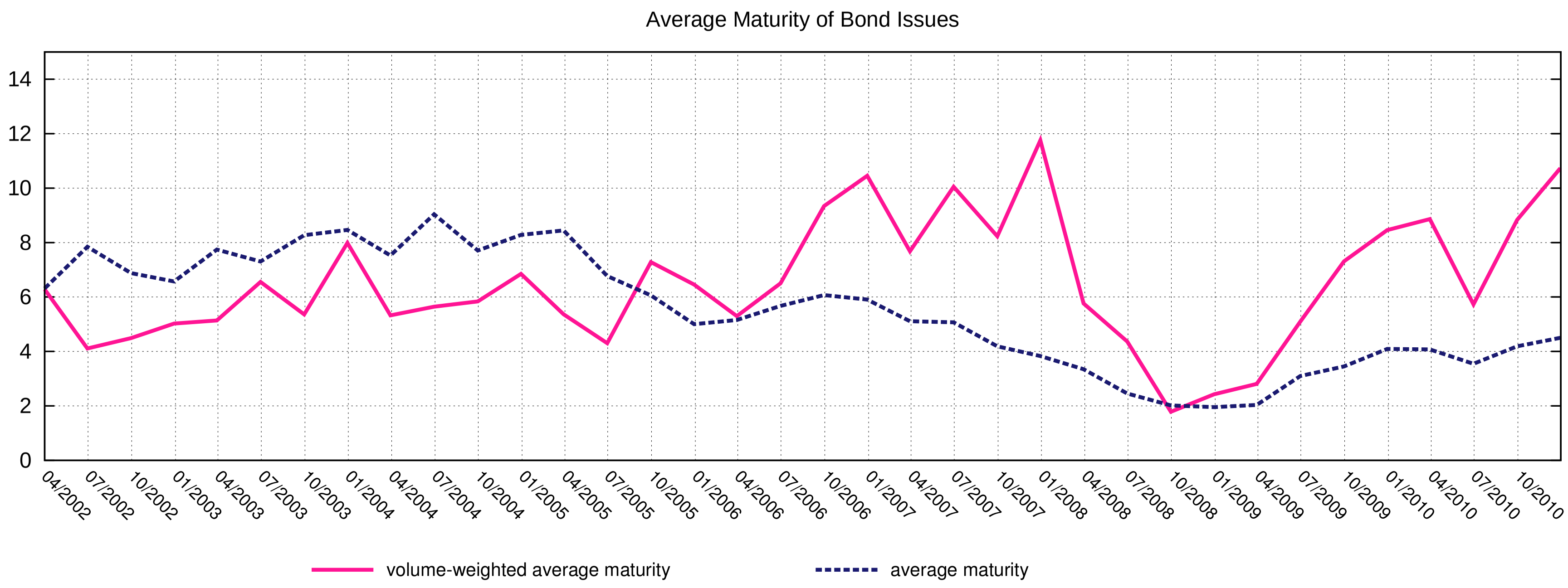


Figure 5: Maturity Structure of Bond Issues by Bank

This chart depicts the evolution of the volume-weighted maturity (M) structure of new bond issues in percent for the U.S. banking sector from 2002 to 2010.

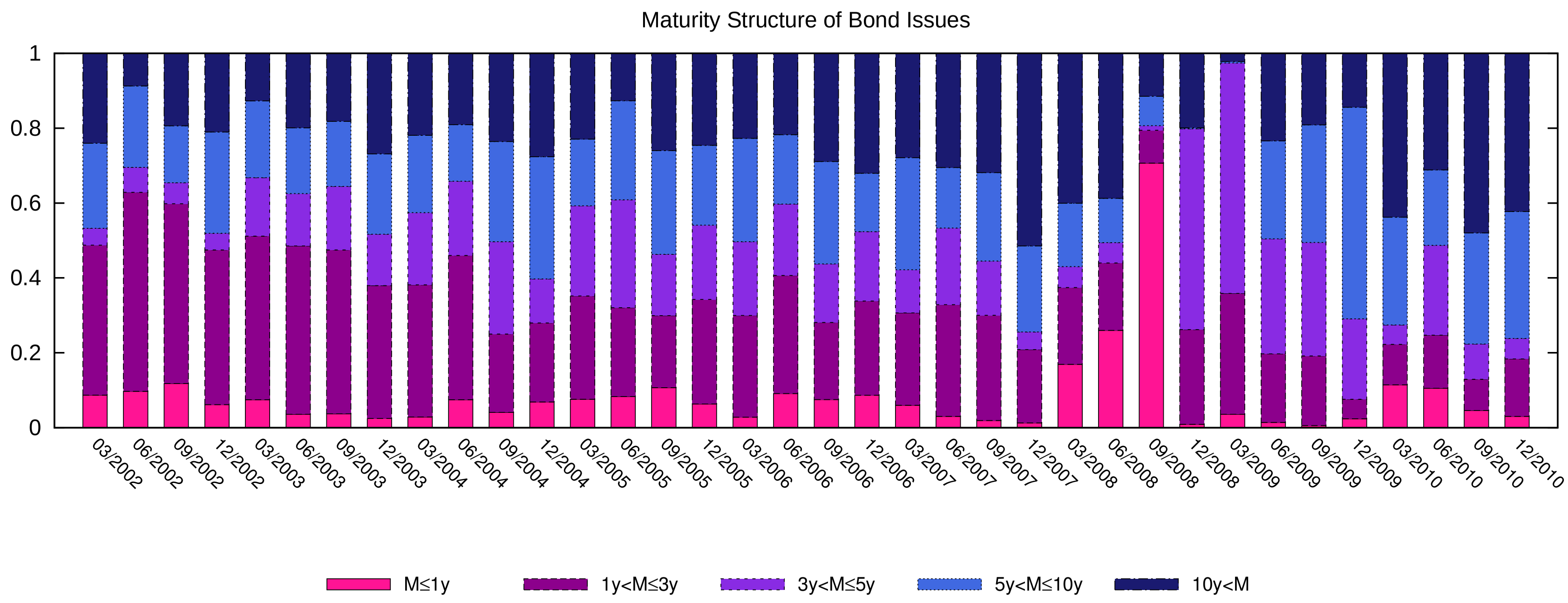


Figure 6: Bond Trades

This chart depicts the evolution of bond trades in the broader financial sector and the bank subsector, both in terms of trading volumes in billions of US$ and numbers, for the period January 2004 to September 2010.

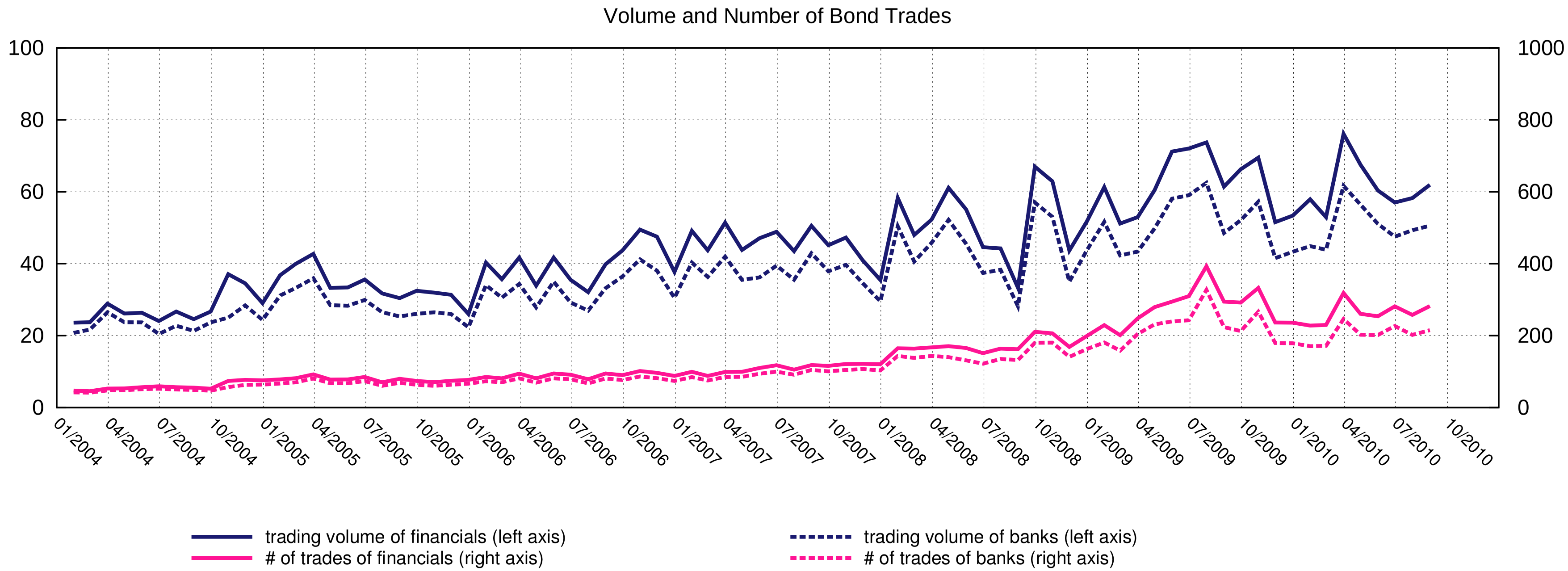


Figure 7: Primary Market Subsidies Implied by a Lower Coupon Rate

This figure shows the evolution of primary market subsidies estimated by lowering the coupon rate relative to the bond issuance volume in the different financial sectors. All numbers are in millions of US$.

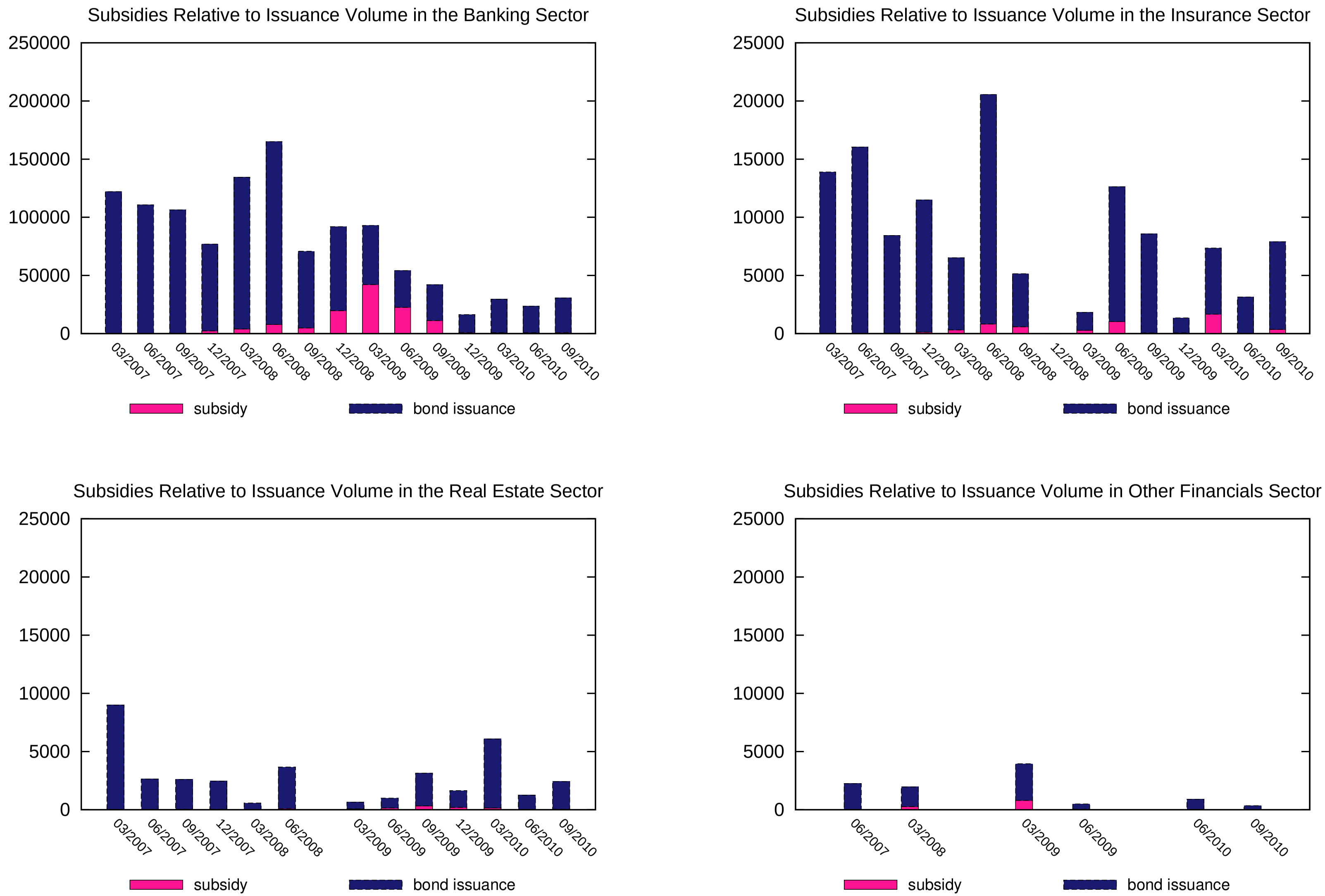


Figure 8: Primary Market Subsidies Implied by a Lower Yield

This figure shows the evolution of primary market subsidies estimated by lowering the yield relative to the bond issuance volume in the different financial sectors. All numbers are in millions of US$.

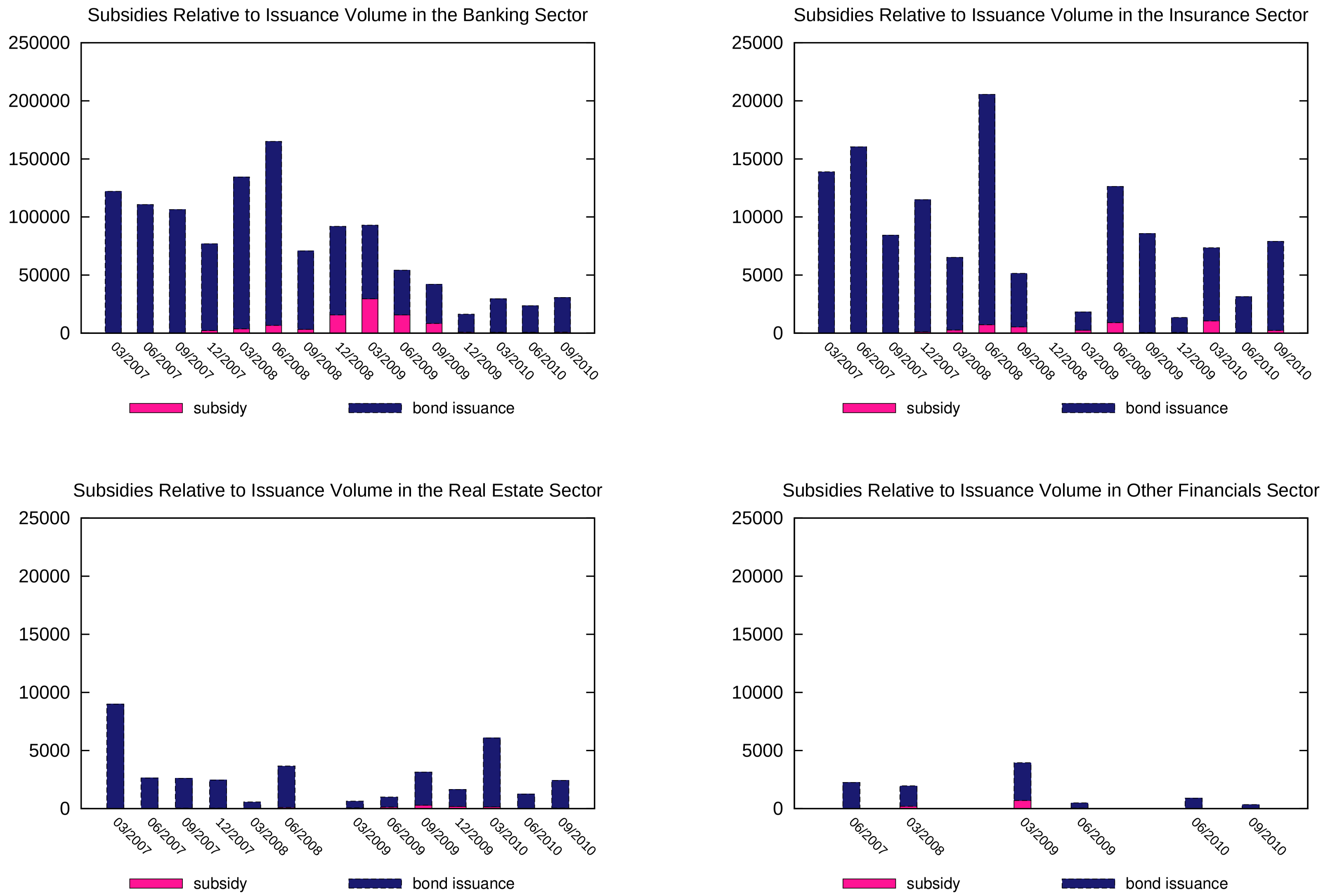


Figure 9: Secondary Market Subsidies Implied by a Lower Yield

This plot illustrates the evolution of secondary market subsidies that are estimated continuously using contemporaneous trading volumes for the whole financial sector and the bank subsector. Monetary amounts (on the left axis) are in millions of US$.