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The Market Survival of Publicly Traded Traditional and Market-Based Financial Intermediaries

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Abstract

The financial crisis highlighted the pivotal role that financial intermediaries play in the economy. Recent research has analyzed the differences between traditional and market-based financial intermediaries, noting the greater balance sheet volatility of the former category. Using these volatility differences as a basis, this paper compares the stock market delisting behavior of market-based and traditional financial intermediaries. Using survival analysis, I find that market-based intermediaries carry greater cumulative incidence of stock market delisting due to firm failure and M&A activity relative to traditional intermediaries. Additionally, idiosyncratic risk plays an important role in the survival behavior across these institutional structures.

JEL Classifications: G20, G21

Keywords: financial intermediation, survival analysis, idiosyncratic risk, banks, delisting, M&A

1. Introduction

According to Adrian and Shin (2010b), since the 1980s, there has been a dramatic shift away from traditional deposit-based financial intermediaries (i.e. standard commercial banks), towards the growth and emergence of market-based intermediaries such as securities broker-dealers and shadow banks[1] (e.g. asset-backed security issuers). The latter form of institutional structure has been gaining market share with respect to the traditional commercial banking sector over the past thirty years. While traditional financial intermediaries function as depository institutions, using their customer deposits as a primary source of investment funds, the market-based intermediaries, as classified by Adrian and Shin (2010b), rely heavily on short-term borrowing channels, such as commercial paper or repurchase agreements, as sources of capital.

Adrian and Shin (2010a, 2011) analyze the behavioral differences of these two types of intermediaries using their balance sheet and leverage behaviors. The research indicates that the market-based intermediaries display a stronger procyclical asset-to-leverage growth relationship. In other words, since market-based firms, relative to traditional firms, exhibit higher leverage during asset booms and lower leverage during asset busts, these market-based intermediaries have more volatile fluctuations in their balance sheets.

Using these balance sheet differences as a basis, the primary purpose of this paper is to compare the firm survival behavior, in the form of stock market delisting, across market-based and traditional financial intermediaries. Additionally, I examine the role of idiosyncratic risk in explaining this survival behavior. The primary hypothesis argues that the greater balance sheet volatility of the market-based firms (i.e. greater risk) will lead to lower relative survival rates and greater cumulative incidences of stock market cause-specific delisting behavior for the market-based institutions. This is the first research to explore the differences between these two types of intermediaries from the perspective of delisting and M&A activity and survival.

The primary hypothesis is examined using survival analysis. Survival functions are estimated for each intermediary group, using a sample of firms that were newly listed on the exchange within the 1980Q1-2009Q4 period. The failure event, with respect to survival, is stock market delisting. Given that publicly traded firms can delist for several different

[1] According to Pozsar et al. (2010), shadow banks are "financial intermediaries that conduct maturity, credit, and liquidity transformation without access to central bank liquidity or public sector credit guarantees."

reasons, cause-specific cumulative incidence functions are also estimated. These functions analyze the probability of firms in each intermediary group losing exchange-traded status due to firm failure or due to a merger event. The results indicate that publicly traded market-based intermediaries carry a much lower survival rate, in terms of general stock market delisting, relative to the traditional intermediaries. Upon dissecting this delisting behavior into two separate causes, in both instances, firm failure and M&A activity, the cumulative incidence functions show a greater relative likelihood of delisting associated with the market-based financial institutions.

In order to link the cumulative incidence behavior associated with the market-based intermediaries to their firm-specific risk behavior, a competing risks variation of the Cox Proportional Hazards model is estimated. Across all model specifications, idiosyncratic risk has a strong, positive and significant, impact with respect to delisting due to firm failure. These results indicate that idiosyncratic risk plays a role in explaining the survival behavior differences across these intermediary groups. On the other hand, idiosyncratic risk has a negative effect on the M&A delisting behavior for the market-based intermediaries, while having no impact, or possibly a canceling effect for the traditional intermediaries.

This analysis extends the previous literature regarding the balance sheet volatility differences across intermediary types to examine the market survival of publicly traded financial intermediaries. After briefly outlining the data used for this study, I highlight the different balance sheet behaviors across the market-based and traditional financial firms. Following this motivation, the main hypothesis is examined followed by a series of robustness tests and ultimately some concluding remarks.

2. Data Overview

This research focuses the behavior of two groups of publicly traded firms, using both market-based and accounting-based factors into account. The market-based data is from the Center for Research and Security Prices (CRSP) Stock Price database, while the firm-level balance sheet information is from the Compustat database. Since this research focuses on delisting behavior relative to market age, the sample is restricted to financial firms that have newly listed on the exchange from the first quarter of 1980 through the last quarter of 2009. Since Adrian and Shin (2010a) highlight the growth of market-based intermediaries from their beginnings in the mid-eighties, the sample period is selected to roughly coincide with this period.[2]

The financial intermediaries are extracted from the CRSP database using the SIC code classification system. The Office of Occupational Safety & Health Administration (U.S. Department of Labor 2011) categorizes firms in finance, insurance, and real estate with SIC codes in the 6000 range. Adrian and Shin (2010c) define traditional depository-based intermediaries as commercial banks, and the market-based intermediaries as security broker dealers and shadow banks. The shadow banking sector, according to Adrian and Shin (2010c), includes asset-backed security (ABS) issuers, finance companies, and funding companies as defined by the Federal Reserve's Flow of Funds guide (Federal Reserve Governors 2011). Following their defined market segments, I align those specifications as closely as possible with the SIC codes to create the samples of financial intermediary groups as shown in Table 1.[3]

[2] The robustness section also provides an alternative estimation period focusing on the latter half of the sample period.

[3] Given the consolidation of financial companies, the distinction between traditional and market-based intermediaries has become blurry in specific cases. For example, Citigroup Inc. provides retail and commercial banking services, which would qualify it as a traditional depository institution. However, they also have an investment-banking arm, which could fall under the market-based intermediary category. In this analysis, Citigroup is classified by its SIC code distinction as a commercial bank (SIC code: 6021). While this introduces the potential for bias, it is difficult to avoid. Fortunately, these types of firms tend to be classified as traditional depository institutions, which biases against the hypothesis set forth in this study. Therefore, any affirmation of the hypothesis occurs in spite of this bias effectively strengthening the results.

Table 1. Financial Intermediary Classification

SIC Codes	SIC Category	Financial Intermediary Proxy
6000-6099	Depository Institutions	Traditional: Commercial Banks
6200-6299	Security and Commodity Brokers, Dealers, and Exchanges	Market-Based: Security Broker Dealers
6100-6199	Non-depository Credit Institutions	Market-Based: Shadow Banks including ABS Issuers
6712	Offices of Bank Holding Companies[4]	Market-Based: Investment Banks and Shadow Banks including ABS Issuers, Finance, and Funding Companies
6719	Offices of Holding Companies, Not Elsewhere Classified[5]	Market-Based: Shadow Banks including ABS Issuers, Finance, and Funding Companies

The SIC code classifications purged the data of most investment funds and insurance related companies commonly found in this financial category. The data was manually cleaned of any remaining firms that should not be classified as financial intermediaries, such as non-financial firms in the Offices of Holding Companies SIC category. Additionally, following Fama and French (2004), all American Depository Receipts (ADRs) or non-US firms listed on US stock exchanges, were removed from the data set. I also stipulate that firms must have survived at least one year on the exchange to be eligible for inclusion. Lastly, the CRSP delisting codes were used to determine the trading status and delisting behavior of each firm.[6] Using these classifications, a dummy indicator variable is constructed for the delisting and cause-specific failure status for each individual firm over time. Given the data overview, this sample data is used to motivate and subsequently test the hypothesis set forth in this study.

Coupling the above requirements with the restriction that the firms must have listed between the 1980-2009 period, a sample of roughly 2100 firms was created. The CRSP data provides market-based performance and activity for all firms in the sample; however, this data must be matched with the quarterly corporate balance sheet information in the Compustat database. Since the Compustat data is a subset of the CRSP data, after matching these datasets by each firm/security's CUSIP, and excluding firms with missing observations, the final sample includes 861 firms with a total of 24,350 quarterly observations. [7] These firms can further be broken down into their respective intermediary group subsets, with 490 traditional and 371 market-based. As a matter of perspective, the top five largest firms in the final sample by average market cap for the traditional financial intermediary group are as follows: Citigroup, Inc., UBS, MBNA Corp., Suntrust Financial, and Providian Financial. The top five market-based financial intermediaries included in the sample are: Goldman Sachs, Deutsche Bank, Morgan Stanley, Visa, Inc., and Lehman Brothers.

3. Motivating the Differences in Firm Survival between Market-Based and Traditional Financial Intermediaries

3.1. The Varying Risk Behaviors across Financial Intermediaries

Following the financial crisis, the risk behavior of the financial intermediary sector and its subsequent impact on economic activity has been a focus of academics and politicians alike. Adrian and Shin (2010a, 2010c, 2011) examined the balance sheet behavior of these intermediaries and their role in the financial markets, the monetary policy transmission mechanism, and as predictors of national output. Specifically, Adrian and Shin (2010a, 2011) find that both market-based intermediaries and traditional intermediaries display a procyclical asset to leverage growth relationship, where market-based intermediaries display more asset and leverage growth volatility relative to the traditional intermediaries. Using this literature as a foundation, I examine the balance sheet behavior of these two types of intermediaries over the firms in the sample to support the formulated hypotheses of this research. Since greater balance sheet volatility should indicate greater levels of idiosyncratic risk for the market-based firms, this can translate into lower survival probabilities of these firms with respect to stock market delisting.

[4] As of 2009, some very important market-based intermediaries such as Goldman Sachs and Morgan Stanley became registered as Bank-Holding Companies, and fall under this category based on their SIC classifications.

[5] While not reported here, the results of this analysis are robust to excluding these three categories allowing for a sharper definition of market-based intermediaries, with the exception of idiosyncratic risk losing it's significance with respect to M&A activity for market-based intermediaries.

[6] The sample of intermediaries contained one of five possible types of codes. Those firms with delisting codes in the range of 100 were considered active through the end of the sample period in fourth quarter of 2009. Firms with codes within the 200 range were delisted due to some form of merger or acquisition activity, while a code of 300 indicates exchanges of stock. Those firms with codes falling within the span of 400-500 were delisted due to bankruptcy or liquidation as well as bad stock market performance.

[7] As a robustness check, I also replicate the results using only the market-data, which allows for the full sample analysis.

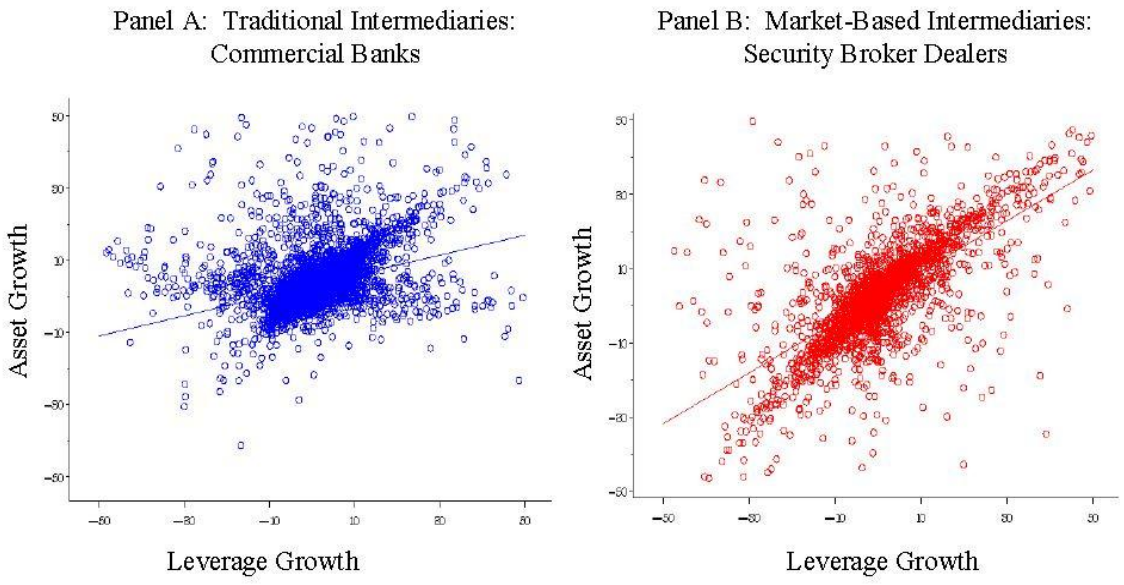


Figure 1. Asset Growth vs. Leverage Growth of Financial Intermediaries

Using the publicly traded sample of financial intermediaries from CRSP and Compustat, Figure 1 displays the relationship between each firm's quarterly asset growth and quarterly leverage growth, where leverage is defined as total assets divided by total equity. The respective panels are separated by intermediary type, where Panel A represents the traditional intermediaries in the form of commercial banks and Panel B the market-based intermediaries by the security broker dealers. The graphs indicate consistency with Adrian and Shin (2011), as both types of firm's exhibit procyclical asset and leverage growth behavior.

During asset booms, with rising asset prices, these firms expand their balance sheets by increasing their leverage; when asset prices fall these firms take steps to drastically reduce their leverage. The steeper trend line implies that market-based firms increase their leverage more than traditional firms in response to an increase in asset growth, and decrease their leverage more than the traditional intermediaries in response to a decrease in asset growth. Since the traditional firms have a relatively weaker asset to leverage growth relationship, it can be deduced that the market-based intermediaries will have more volatile balance sheets that fluctuate with the financial cycles.

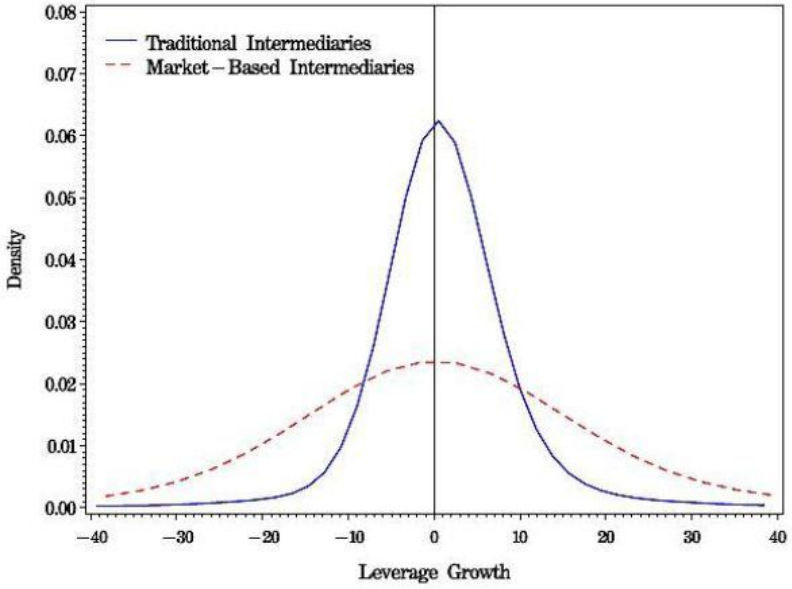


Figure 2. Leverage Growth Density across Financial Intermediaries

As further evidence, Figure 2 plots the density distribution of leverage growth for each type of financial intermediary across all quarters of the sample. Clearly, the volatility of the leverage growth is much higher for the market-based intermediaries relative to traditional depository-based institutions. These volatility differences across intermediary

groups provide glaring evidence of differing balance sheet behaviors across these intermediary groups. The difference in leverage behavior between the market-based and traditional firms provides the motivation for examining the cause-specific delisting survival of these intermediaries and the impact of risk on this survival.

3.2. Linking Firm Risk and Stock Market Survival

The main hypothesis of this analysis states that publicly traded market-based intermediaries will carry a greater likelihood of being delisted from the stock exchange relative to their traditional financial intermediary peers. Previous literature, as well as the data in this sample, has indicated that market-based firms tend to exhibit greater balance sheet volatility, which can impact the survival behavior of these firms. Fama and French (2004) find that the declining cost of equity over the past several decades has allowed weaker, riskier firms easier access to capital in the public markets. The direct implication of this result has been the declining survival rates for newly listed firms. If riskier firms stand a greater chance of being delisted from the stock market, then a priori, the riskier market-based intermediaries should have lower survival rates than the traditional intermediaries. However, while stock market delisting can serve as a failure event for firms in survival analysis, this situation provides added complexity due to the cause of delisting. Specifically, a publicly traded firm can delist for several reasons, most notably due to firm failure or merger and acquisition behavior.

Examining the factors that drive firm failure and M&A activity via the intermediary sector has been examined throughout the literature including Platt and Platt (1990), Wheelock and Wilson (2000), Shumway (2001), and He et al. (2010). However, the financial intermediary literature has focused heavily on the traditional depository institutions, with no mention of the market-based firms. A recurring theme across the literature is the role that risk measures play in impacting these firm behaviors. Platt and Platt (1990) note that balance sheet leverage behavior is associated with greater likelihood of firm failure or liquidation. Additionally, Shumway (2001) found that increases in accounting-based leverage and idiosyncratic risk increase the likelihood of firm failure across multiple sectors.

In terms of acquisition, Wheelock and Wilson (2000) find that thinly capitalized banks (or over-leveraged firms) are prime takeover targets, with greater leverage increasing the chances of acquisition. In the spirit of Wheelock and Wilson (2000), heavily levered financial intermediaries could be more financially vulnerable to corporate takeover. However, this argument hinges on financial distress of the firms, which could also deter other firms from acquisition. Thus, it is difficult to anticipate a theoretical prior for the impact of idiosyncratic risk on M&A activity. However, Amihud and Lev (1981) and Aggarwahl and Samwich (2003) note that one of the driving factors for M&A activity is idiosyncratic risk diversification. In particular, Pasiouras, Tanna, and Zopunidis (2005) state that product diversification is an important determinant in M&A decisions. As a whole, Market-based intermediaries provide a wider variety of financial services, such as mortgage lenders, ABS issuers, investment banks, etc., relative to the standard depository institutions. As such, market-based firms are more likely to be a target for acquisition as firms seek to diversify their product offerings to reduce risk exposure. This motivates the notion that market-based intermediaries should be more susceptible to acquisition on a relative basis.

4. The Empirical Approach to Assessing the Survival Behavior of Market-based and Traditional Financial Intermediaries

At its core, this research is a time-to-event study, with stock market delisting serving as the event of interest. Given the nature of this research, survival analysis is well suited to address the hypothesis, which will be examined in three stages. The first stage analyzes the raw survival behavior of the intermediaries with respect to delisting from the stock exchange, which explicitly tests the hypothesis. However, this stage does not account for the cause of the delisting. The second stage will utilize cumulative incidence functions to analyze the probability of each intermediary group delisting as a result of either firm failure or M&A activity. While the previous two stages provide insight into the survival behavior of these firms, they fail to account for any covariate impacts on this behavior. Thus, the final stage will examine the impact that the idiosyncratic risk differences have on firm survival using the competing risks version of the Cox Proportional Hazards model similar to Wagner and Cockburn (2010) and He et al. (2010).

4.1 Do Market-Based Intermediaries Display Greater Stock Market Delisting Behavior? Methodology and Analysis

The survival behavior of market-based and traditional financial intermediaries is examined using Kaplan-Meier survival curves and cumulative incidence functions. Kaplan-Meier (KM) survival functions analyze the raw survival behavior of different populations in the absence of any covariates. In this case, the different populations include market-based and traditional financial intermediaries. According to Therneau and Grambsch (2000) the KM estimator constructs survival curves based on the analysis of the Nelson-Aalen (NA) estimator[8] of the cumulative hazard function. The survival

[8] The NA estimator represents the average number of failures from (0,t] for every firm that is perpetually at risk. Therneau and

curve describes the cumulative probability of firm survival over each collective group.[9]

Figure 3 depicts the survival curves of both market-based and traditional firms with respect to delisting from the stock exchange. The time period indicates the market age of the firm from its initial listing on the exchange. In this specification, the publicly listed market-based intermediaries display much lower survival rates over time relative to depository institutions. Specifically, a broker dealer or shadow bank has a 25% chance of surviving 12 years (48 quarters) on the exchange after listing, while a commercial bank stands a 42% chance of survival. These results validate the primary hypothesis of this research.

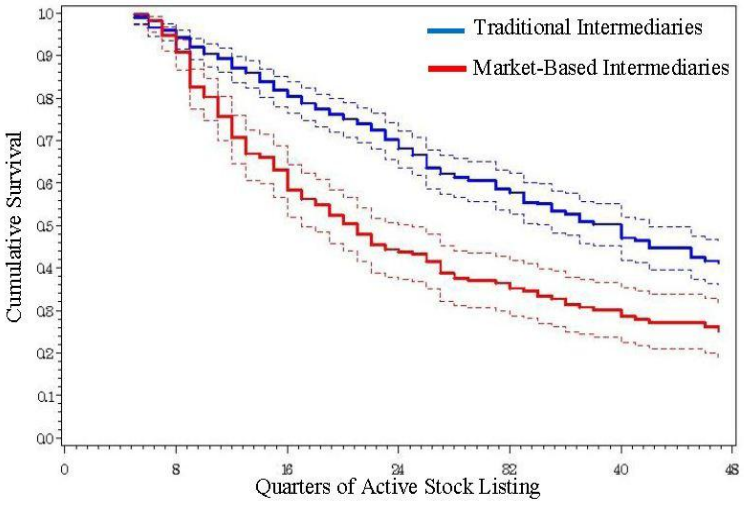
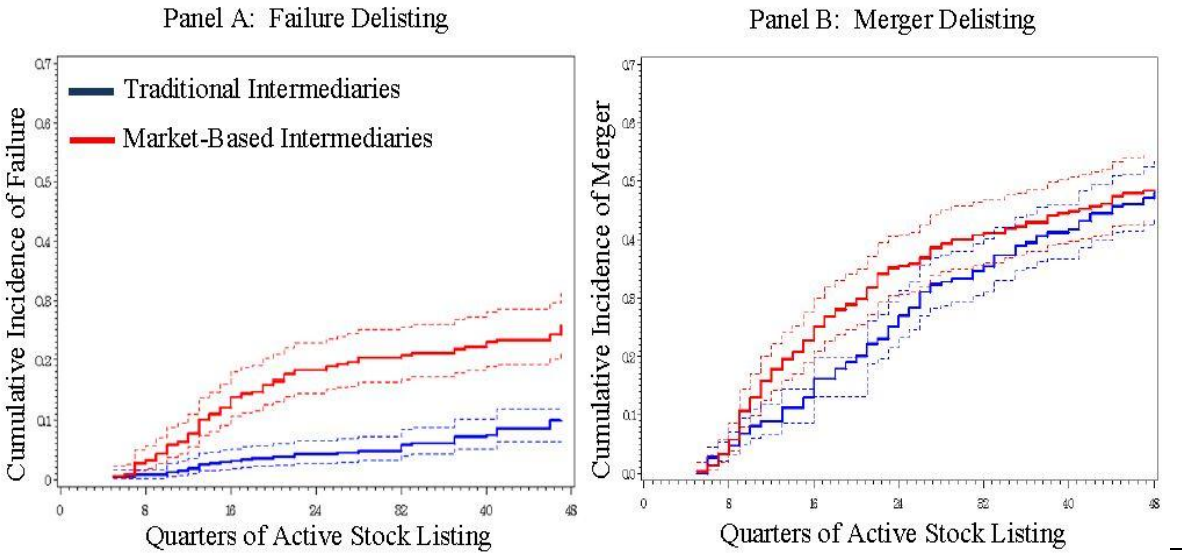


Figure 3. Survival Functions against Non-Cause Specific Stock Delisting Across Financial Intermediaries

While the survival functions in Figure 3 explain the overall delisting behavior of these firms across intermediary groups, they fail to address the different causes of delisting. From a statistical perspective, Pepe and Mori (1993) note that in a competing risks framework, standard survival probabilities can be biased due to censored observations. While the cause-specific hazards can yield consistent estimates, the final survival probabilities fail to account for the other causes of failure due to censoring.



Grambsch (2000) define the NA estimator or cumulative hazard, $\widehat{\Lambda}(t)$, in the following form: $\widehat{\Lambda}(t) = \sum_{i:t_i \le t} \frac{\Delta \bar{N}(t_i)}{\bar{Y}(t_i)}$. In this specification, $\bar{N}(t_i)$ represents the total number of failures up to and including time t, while $\bar{Y}(t_i)$ indicates the number of firms that are potentially at risk of failure at time t. Using this calculation, the NA estimate of the integrated or cumulative hazard can be obtained.

[9] The KM estimator utilizes the NA estimate to obtain the survival function, which takes the following form: $\widehat{S}(t) = \exp[-\widehat{\Lambda}(t)]$.

Figure 4. Cumulative Incidence of Cause-Specific Delisting Across Financial Intermediaries

To correct this issue, Porta el al. (2008) state that the joint distribution can be specified using cumulative incidence functions, which depict "the probability of failing from a given cause before a specific time." In this framework, all causes of failure are utilized to estimate the cumulative incidence function for a given cause, and thus other failures are not treated as censored observations. Essentially the cumulative incidence function approach will indicate the likelihood of failure for a particular risk, while accounting for the other possible sources of failure, which will determine the respective delisting risk for each type of intermediary.

Figure 4 reports the cumulative incidence functions for both intermediary groups across each cause specific delisting behavior. Across both institutional types, firms are more likely to be delisted due M&A activity than to firm failure. Additionally, the market-based intermediaries, relative to the traditional firms, have a greater risk of experiencing either of these events. However, the distinction between these groups for M&A activity is not as drastic as the case of failure delisting.[10] These functions, when combined with the survival function, all validate the claim that publicly traded traditional intermediaries have a greater likelihood of survival on the stock exchange relative to the market-based intermediaries in the face of failure or merger delisting risks.

4.2 Can Firm-Specific or Idiosyncratic Risk Justify the Delisting Behavior? Methodology and Analysis

4.2.1 Cox Proportional Hazards Model with Competing Risks Methodology

While the above approach allows for a comparison of firm survival and incidence, it does not explain the factors that may be driving these behaviors, such as firm-specific risk. The impact of firm-specific risk on firm survival is examined using the competing risks augmented Cox proportional hazards model. Previous literature, including Wagner and Cockburn (2010), He et al. (2010), and Wheelock and Wilson (2000), has used this methodology in the IPO context to examine cause-specific delisting behavior. In this analysis, I examine the impact of certain factors on firm failure and M&A stock delisting, specifically highlighting the role of firm-specific or idiosyncratic risk on these behaviors.

For this competing risks model, I assume that every firm *i* can be delisted from the stock market at any time *t*, subject to either firm failure or acquisition. Let *j=1* represent firm exit due to failure and *j=2* represent delisting due to acquisition. In this model *j* and *t* are both observed as well as T_j, which represents the actual time of failure corresponding to the event type. Thus, the final notation assumes that $T=min(T_j, j=1,2)$ and that $J=arg\ min(T_j, j=1,2)$, corresponding to the actual failure time due to the actual event type. Following the notation of He et al. (2010), a hazard function can then be calculated for each type of failure event:

$$\lambda_j(t) = \lim_{\Delta t \to 0} \frac{\Pr(t \le T \le t+\Delta t, J=j \mid T \ge t)}{\Delta t} \tag{1}$$

After obtaining the estimates for the hazard function for each event type, the Cox proportional hazards model will use these hazards as the dependent variable in its partial likelihood estimation framework. The analysis of the hazard function in the competing risks version of the Cox model takes the following form:

$$\lambda_{ji}(t) = \lambda_{0j}(t) \exp\left[x'_{ji}(t)\beta_j\right] \qquad j = 1,2 \tag{2}$$

In this specification, $\lambda_{0j}(t)$ represents the baseline hazard (or the effect of time on the delisting behavior with respect to failure type *j* when the covariates assume a value of zero), $x'_{ji}(t)$ is a vector of time dependent covariates at time *t* with respect to failure *j* for each firm *i*, and β_j denotes a vector of parameter estimates to be obtained from the regression. This estimation will results in *j* sets of coefficient estimates, one set for each respective delisting event in this case.

The construction of the base model will follow Shumway's (2001) approach of combining accounting and market-based measures with different variable specifications. The accounting or balance sheet variables will include a measure of the firm's growth taken as the growth rate in assets, and a measure of the firm's profitability in the form of net income relative to assets.[11] The market-based variables include the security's quarterly excess stock returns relative to the

[10] The robustness section contains an alternative version of the M&A cumulative incidence functions, which are calculated on a broader firm sample. Under this specification, the market-based intermediaries display a much greater likelihood of being acquired relative to the traditional firms as shown in Figure A.2 of the Appendix.

[11] While the total assets measure appears in some form of each of these variables, a Pearson correlation analysis was conducted and found no evidence of correlation issues amongst these terms. Shumway (2001) also included total liabilities/total assets as a leverage

value-weighted quarterly market performance,[12] the relative size of each respective firm as natural log of the firm's market capitalization relative to the entire NYSE, AMEX, and NASDAQ market capitalization, and a measure of idiosyncratic risk.

The firm-level measure of idiosyncratic risk is created in the spirit of Shumway (2001). This process involves fitting a regression of the individual excess stock return on the excess market return in each quarter for each security in the dataset using weekly data.[13] After fitting the regression, the standard deviation of the monthly residuals for each security is calculated to yield a quarterly measure of idiosyncratic risk. Specifically, I utilize the Fama and French (1993) three-factor model to construct this measure, as this approach is known to be a better predictor of individual firm excess returns than the Capital Asset Pricing Model (CAPM).[14]

As a matter of perspective, the results of this approach coincide with the notion that market-based firms, on average, tend to exhibit greater firm-specific risk. Figure 5 displays the equal-weighted average of idiosyncratic risk across the firms in the sample divided into market-based and traditional financial intermediaries, where the former category exhibits greater idiosyncratic risk beginning in the early 1990's through the mid 2000's.

4.2.2. Results: Idiosyncratic Risk and Delisting Behavior

Given the econometric overview, the results of the competing risks Cox proportional hazard model are presented in Table 2. The estimation in this table includes all firms in the sample that have been newly exchange listed within the 1980Q1 through 2009Q4 period and satisfied the requirements in the data section. This table reports the coefficient estimates across the pooled sample for the risk of being delisted due to either cause, delisting due to firm failure, and delisting due to merger and acquisition activity.

The purpose of estimating this model is to ascertain the impact of idiosyncratic or firm-specific risk in explaining the delisting behavior of these two types of intermediaries.[15] The results of this model validate the claim that idiosyncratic risk increases the likelihood of firm failure for both types of intermediaries. In both specifications, the idiosyncratic risk measure has a positive and statistically significant impact, which is consistent with Shumway (2001) and Wheelock and Wilson (2000). In regards to M&A stock market delisting, idiosyncratic risk has a different impact, as it is statistically insignificant with respect to this behavior for traditional intermediaries and displays a negative and statistically significant impact for the market-based intermediaries.

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measure. Given that the firm-specific or idiosyncratic risk can proxy for the variability of the firm's balance sheet, I excluded leverage from the main model. For robustness, I also estimated the model including leverage growth as an accounting variable, which did not impact my key results.

[12] The market is defined as the index of all securities listed on the NYSE, AMEX, and NASDAQ exchanges as extracted from CRSP following Shumway (2001).

[13] Idiosyncratic risk is often calculated on a monthly frequency, whereby regressions are fit on daily stock market data for each month and monthly idiosyncratic risk is calculated as the standard deviation of the daily residuals. As such, idiosyncratic risk was also analyzed using the daily data over the sample as a robustness check. The results presented here are valid using this approach as well.

[14] The Fama and French (1993) model regresses the excess return of a security on the excess market return and risk factors related to size and book/market equity. The resulting beta for the excess market return indicates each security's systematic risk relative to the market, while the standard deviation of the residual is the proxy for the firm's idiosyncratic risk across the time period. The model takes the following econometric form[14]:

$$R_t - RF_t = \alpha + \beta(RM_t - RF_t) + \delta SMB_t + \gamma HML_t + \varepsilon_t$$

In this specification the dependent variable is the excess weekly return of a security relative to the 1-month T-bill or risk free rate, RF_t, as provided by French (2011). The first regressor represents the excess market return (measured as return of NYSE/AMEX/NASDAQ index of securities) relative to the risk free rate, and the last two covariates are the portfolio factors constructed by Fama and French (1993). The SMB factor captures the difference in returns between small and big stock (capitalization) portfolios, while the HML factor represents the difference in returns between high book-to-market equity and low book-to-market equity portfolios.

[15] A pooled model across both intermediary types was first estimated followed by a Schoenfeld Residual test of the proportional hazards assumption across the groups (Therneau and Grambsch 2000). The test indicated failure of this assumption, suggesting these two groups should be estimated via stratification or as separate models.

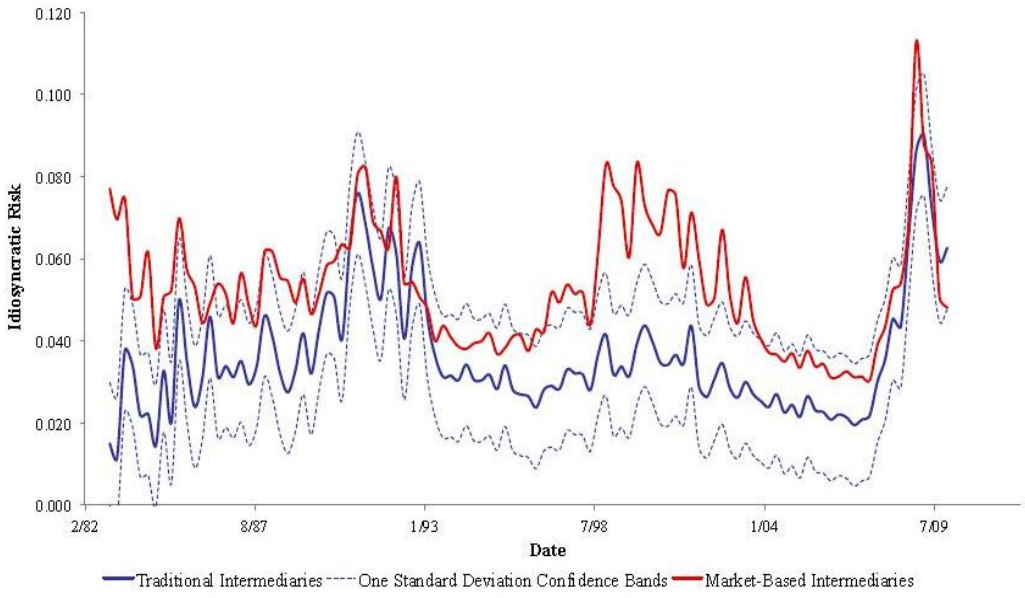

Figure 5. Idiosyncratic Risk across Financial Intermediary Groups:
Equal-Weighted Construction

Table 2. Full Sample Competing Risks Model (1980Q1-2009Q4)

Full Sample	Traditional Intermediaries			Market-Based Intermediaries		
	Delisting: All	Delisting: Failure	Delisting: Merger	Delisting: All	Delisting: Failure	Delisting: Merger
Growth	-1.965 *** (0.000)	0.257 (0.817)	-2.900 *** (0.000)	-0.427 (0.173)	-0.126 (0.772)	-1.034 ** (0.023)
Profitability	0.027 (0.190)	0.008 (0.905)	0.031 (0.118)	-0.010 * (0.063)	-0.016 *** (0.010)	0.007 (0.571)
Excess Return	1.848 *** (0.000)	-0.439 (0.424)	2.692 *** (0.000)	0.116 (0.488)	-0.935 *** (0.001)	0.962 *** (0.000)
Relative Size	-0.162 *** (0.001)	-0.966 *** (0.000)	-0.056 (0.245)	-0.206 *** (0.000)	-0.672 *** (0.000)	-0.039 (0.366)
Idiosyncratic Risk	3.879 *** (0.004)	8.092 *** (0.000)	-2.959 (0.191)	2.957 *** (0.005)	7.256 *** (0.000)	-4.373 ** (0.042)
Number of Firms	490	490	490	371	371	371
Number of Firms with Event Occurrence	269	46	223	250	80	170

Notes:

1. Variable Definitions: Firm Growth = growth rate of total assets | Profitability = net income/total assets | Excess Return = difference between firm quarterly return and value-weighted return of all stocks listed on the NYSE/AMEX/Nasdaq as obtained from CRSP | Relative Size = ln(market value/market value of NYSE/AMEX/Nasdaq index) | Idiosyncratic Risk = squared residual from Fama and French (1993) model
2. 1%, 5%, 10% significance levels denoted ***, **, * respectively.
3. P-values are indicated in parenthesis.

In addition to the risk measure, the remaining variables conform with much of the previous literature and intuition, as more profitable, better stock performing, and larger capitalized market-based intermediaries are less likely to delist from the stock market. These intermediary types are also less likely to be acquired if they are experiencing increasing asset growth and better performing stock returns. Traditional intermediaries follow similar traits in regards to their delisting behavior in terms of market capitalization having a negative impact of delisting failure. The mergers and acquisition delisting risk however, hinges on asset growth and excess returns for this group.

Taking stock of the results, idiosyncratic risk plays a key role in the failure delisting behavior across both forms of

intermediaries; while this risk only impacts the M&A delisting behavior for the market-based firms. Can these results explain the greater delisting rates and lower survival probabilities from the previous section associated with the market-based intermediaries? Conducting a Wald test, in the form of Allison (2004)[16], across the coefficients for both risk measures with respect to delisting due to firm failure, shows that the marginal effects have a statically similar impact on the instantaneous risk of failure. Given that market-based intermediaries display greater tendencies toward idiosyncratic risk, and idiosyncratic risk is an important factor in the failure behavior of these firms yielding statistically similar marginal effects, I conclude that idiosyncratic risk can explain some of the variation in the survival and cumulative incidence behavior across these firms.

In terms of the M&A delisting, idiosyncratic risk is statistically significant in explaining the market-based intermediary behavior, but has no impact for the traditional intermediaries. As previously noted, there are valid arguments for both positive and negative effects. The first argument states that riskier firms may be more susceptible to acquisition given their weaker state, however, the counter argument suggests these high-risk levels could deter firms from M&A behavior. These conflicting views could have a canceling effect for the traditional intermediaries resulting in the insignificant impact.

The negative effect of idiosyncratic risk for the market-based intermediaries, suggests their higher risk levels should reduce the M&A activity in this sector. However, in spite of this negative effect, the market-based intermediaries still carry a higher cumulative incidence of M&A delisting as shown in Figure 4. One possible explanation for this phenomenon is the very nature of market-based intermediaries relative to traditional intermediaries in terms of product and service diversification. Since market-based intermediaries are much more diverse in terms of the types of services they provide, they are prime targets for M&A for the purpose of diversifying the acquiring firm's exposure to various market segments as described by Pasiouras, Tanna, and Zopunidis (2005).

Ultimately, these results indicate that idiosyncratic risk plays a significant role in likelihood of a firm remaining actively traded on the stock exchange relative to delisting due to failure or poor performance. Additionally, the merger and acquisition delisting behavior of the market-based intermediaries is also influenced by the idiosyncratic risk measure.

5. Examining the Robustness of the Results

While the previous findings provide convincing evidence of the risk-based differences between the two types of financial firms, I examine the robustness of these results with respect to the sample period as well as the sample of firms in the estimation. The findings of these robustness checks confirm and strengthen the aforementioned claims regarding variations across these two types of intermediaries.

5.1. Are the Results Robust to the Sample Time Period?

The initial sample data included any publicly traded financial institution that became newly listed between 1980Q1 and 2009Q4. However, the comparison of idiosyncratic risk amongst the intermediary types, as displayed in Figure 5, shows visual evidence of a shift in the risk behavior of these firms during the early to mid-nineties. It's possible that the sample period may be driving the statistically similar covariate impacts of idiosyncratic risk on firm failure and delisting from the previous regressions. By excluding the earlier period from the sample, and isolating only the firm behavior over the past decade and half, the results could yield stronger effects for the market-based intermediaries in relative terms.

In order to determine the starting period for the reduced sample, I examine the idiosyncratic risk behavior for evidence of a structural break. Using the equal-weighted specification for the market-based intermediaries, as displayed in Figure 5, and standard Box-Jenkins methodology along with the Bayesian Information Criterion (BIC) for lag length selection, I conduct a series of Chow Tests to locate any structural breaks to segment the sample period. The stationary series is fit to an AR(1) process whereby Chow tests isolate an initial structural break.[17] Based on the F-values in the Appendix Table A.1, the test indicated that the period between 1992Q1 and 1993Q4 indicates a shift in the risk behavior of the market-based intermediaries. Thus, the previous regressions are analyzed over the sample period from 1992Q1 through

[16] Allison (2004) provides a Wald chi-square statistic for testing the differences in parameter estimates across two independent groups. Given the null hypothesis of statistically similar coefficients, this analysis yields a chi-square test statistic of .046, which fails to exceed the 5% percent critical value. The failure to reject the null hypothesis suggests these coefficients are statistically similar. The assumption of independent groups is questionable with respect to M&A activity. However, in terms of failure, the failure of a particular market-based firm is likely independent of the traditional firms, with the exception of a systemic crisis.

2009Q4.[18]

The new sample, with firms listed between 1992Q1 and 2009Q4, reduced the number of included firms from 861 to 726 in the estimation. The results of this model specification are located in Table A.2 of the Appendix.[19] The shortened sample period also reduced the idiosyncratic risk covariate effects for the traditional intermediaries, while simultaneously increasing the effects for the market-based firms for stock market delisting associated with firm failure.[20] This result adds credence to the full sample model results. The impacts of idiosyncratic risk on M&A delisting activity are also echoed in this specification, with a large negative impact on the market-based intermediary delisting.

5.2 Are the Results Sensitive to Sample Selection Bias?

The original data collection approach to this analysis combined the market-based data from CRSP with the balance sheet data from Compustat. Unfortunately this matching process, combined with other restrictions and missing data caused several companies to be excluded from the sample. However, the data from CRSP is complete and thus the impact of idiosyncratic risk on the delisting behavior can be analyzed using only market-based variables for analysis. This specification mirrors the model from Shumway (2001). Given the structural break indicated above, I estimate the complete firm sample over the 1992Q1-2009Q4 period, which resulted in 1,447 firms for analysis.[21] However, prior to the covariate analysis the initial survival functions and cumulative incidence functions can be analyzed using the full data sample, subject to the requirements in the data section.

Figures A.1 and A.2, in the Appendix, present the survival and cumulative incidence functions for the market-based and traditional intermediaries over the complete firm sample from 1992Q1 to 2009Q4. The results mirror the previous sample whereby the market-based intermediaries exhibit relatively lower survival rates and higher cause-specific likelihood of delisting due to failure and M&A activity. In fact under this specification, the delisting due to M&A activity is distinctively higher for the market-based intermediaries, whereas the previous analysis shows a more similar cumulative incidence function across the groups.

To examine to covariate effects of idiosyncratic risk over this sample of 1,447 firms using just the CRSP data, only the three market-based variables are included in the model in the form of Shumway (2001). The results of this model specification are presented in Table A.3 of the Appendix. The final table reports the estimation while analyzing the intermediary groups separately. As expected the results of the previous analysis in terms of sign and significance remain valid under the full sample specification.[22]

6. Concluding Remarks

The events of the financial crisis have called for a better understanding of the role that financial intermediaries play in the overall economy. Recent research by Adrian and Shin (2009, 2010a, 2010b, 2010c, 2011) has placed great emphasis on examining the risk appetite of two distinct groups of financial intermediaries: traditional depository institutions and market-based intermediaries. Using the Federal Reserve's Flow of Funds data, Adrian and Shin (2010a) highlight the greater balance sheet volatility associated with the market-based intermediaries relative to the standard depository institutions over the past several decades.

Given that previous literature has associated market-based firms with greater balance sheet volatility, the main hypothesis of this analysis postulates that publicly traded market-based financial intermediaries will carry of greater likelihood of being delisted from the stock exchange for corporate failure, or merger and acquisition activity. Using survival analysis, this analysis confirms that market-based intermediaries have a lower cumulative probability of stock

[23] There is also a structural break that occurred in 2007Q3 due to the financial crisis. An additional model was also estimated using firms that listed between 1992Q1-2007Q2, which also supports the previous results found in this analysis.

[19] While not presented here, the impacts of idiosyncratic risk were also examined over the shortened sample from 1980-1992. In this specification, idiosyncratic risk lost its statistical significance for all cases, with the exception of the market-based intermediaries delisting failure, where it had positive impact consistent with the previous results.

[20] Note, however, that application of the aforementioned Wald chi-square test from Allison (2004) still indicates that these coefficients are statistically similar yielding a test statistic of 1.35, which again fails to reject the null hypothesis. These results directly support the results of the previous specification.

[21] The full data sample (including 2,135 firms, 1233 traditional and 902 market-based intermediaries) based on the 1980Q1-2009Q4 period was also analyzed as a robustness check. This sample also mirrored all of the previous results, with the exception of idiosyncratic risk being negative and significant for the traditional intermediaries with respect to M&A activity, similar to the effect for the market-based firms.

[22] As the previous cases, the Wald chi-square test on the idiosyncratic risk coefficients indicates these are statistically similar with a test-statistic of .77. Again, this supports all the previous specifications.

market survival relative to the traditional intermediaries. The delisting event is further decomposed into two forms, delisting due to firm failure and delisting due to firm acquisition. Cumulative incidence functions are estimated to examine the cumulative probability of each separate delisting cause occurring across the firm specifications. The results also validate the hypothesis as both cause-specific delisting events indicate greater likelihood of occurrence associated with market-based firms.

Using a competing risks augmented version of the standard Cox Proportional Hazards model, the effect of idiosyncratic risk is also assessed with respect to the risk of delisting. Across various sample period estimations, idiosyncratic risk has a positive and statistically significant impact on the risk of firm failure and subsequent delisting. This variable however, only has an impact on merger and acquisition risk for the market-based intermediaries. The results of these models indicate that the survival ability of the publicly traded firms can indeed be linked to the idiosyncratic risk measures of the respective firms.

This research has an important policy implication, as it pertains to government bailouts of financially distressed firms. A provision of the Dodd-Frank Act (2010) established the creation of the Financial Stability Oversight Council, which is responsible for monitoring the potential systemic risk of the financial sector. This Council has among its many objectives the task of regulating non-bank financial companies and strengthening capital standards. This research provides further ammunition for the need to regulate this specific type of financial intermediary. Additionally, the Dodd-Frank Act (2010) also places restrictions on taxpayer funded bailouts for financial firms and enacts a number of provisions to strengthen the transparency and monitoring of these financial firms. The goal of these provisions is minimize the risk of any potential, catastrophic, failures in the future.

In the face of a similar crisis situation reoccurring in the future, in terms of bailouts or even liquidity assistance from the Federal Reserve, this research can provide valuable insight. While the analysis is conducted over publicly traded firms, given data availability, the results can extend to non-publicly traded intermediaries as well. This suggests if financial intermediaries in the future find themselves in the position of needing assistance from the government or the Federal Reserve, greater caution must be taken with respect to lending to market-based firms relative to traditional firms, as the former is less likely to survive.

Ultimately, the market-based intermediaries not only carry greater balance sheet volatility relative to standard depository institutions, but this risk also extends to their survival ability.

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Appendix: Supplement Figures and Tables

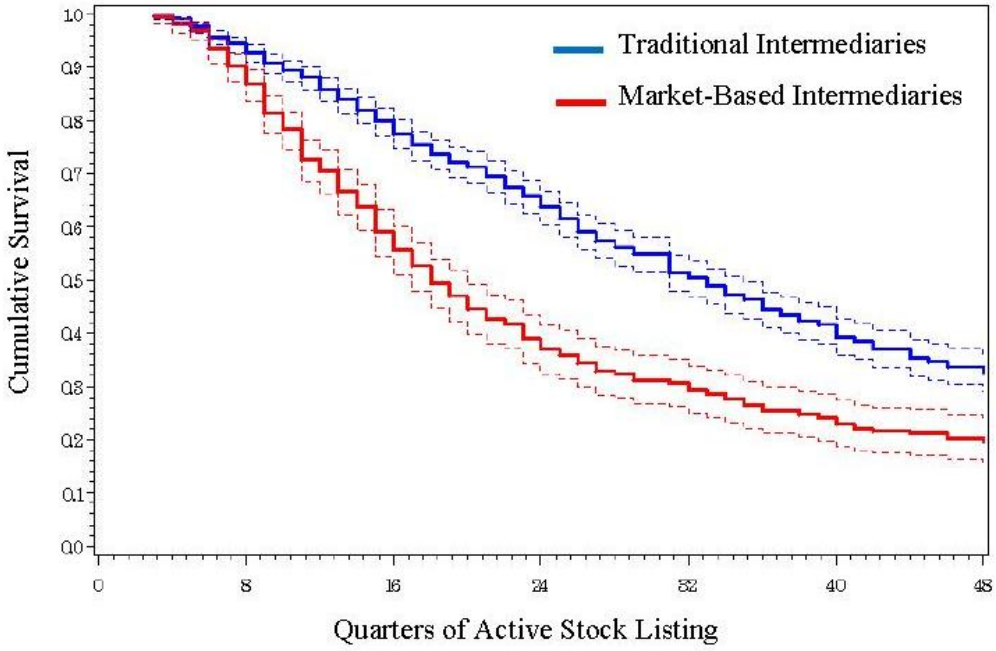


Figure A.1 Survival Functions against Non-Cause Specific Stock Delisting Across Financial Intermediaries (Full Data Sample)

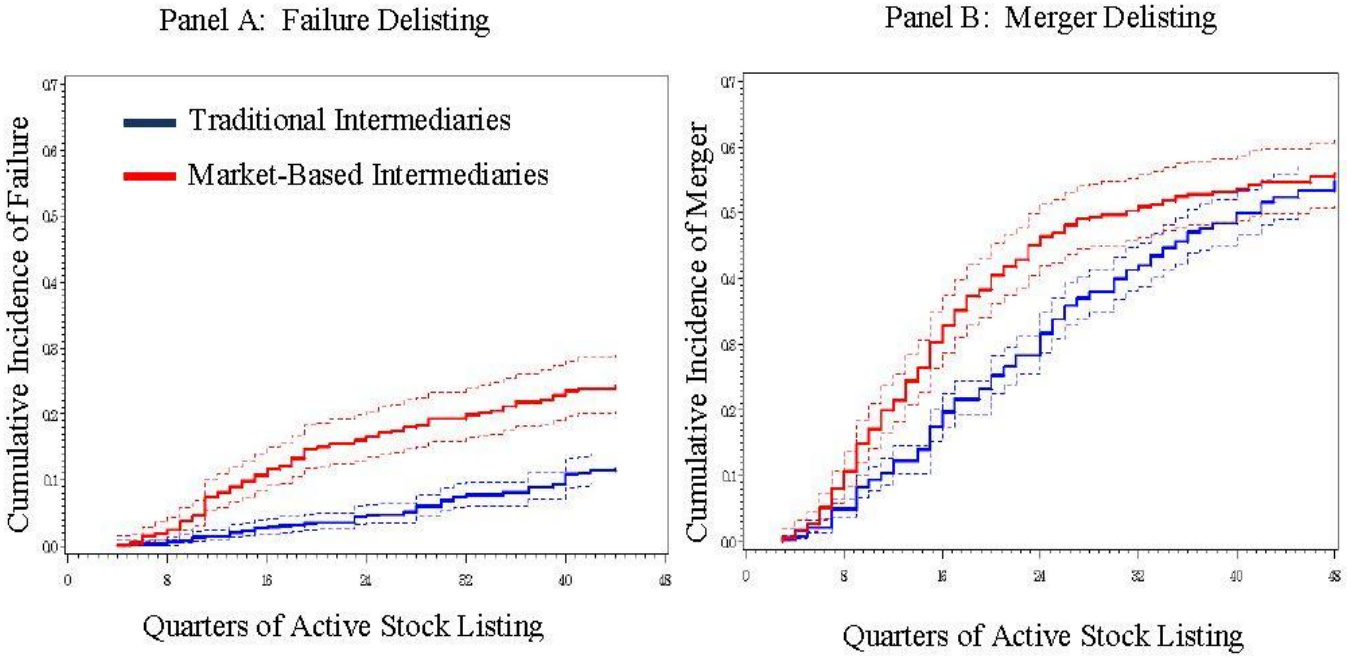


Figure A.2. Cumulative Incidence of Cause-Specific Delisting Across Financial Intermediaries (Full Data Sample)

Table A.1 Time Series Analysis and Diagnostics of the Equal-weighted, Market-Based Financial Intermediaries' Idiosyncratic Risk Measure with Chow Tests

Panel A: Unit Root Test

Augmented Dickey-Fuller Test		
Single Mean	Tau Statistic	P-Value
Market-Based Intermediaries Idiosyncratic Risk	-3.34	0.0156

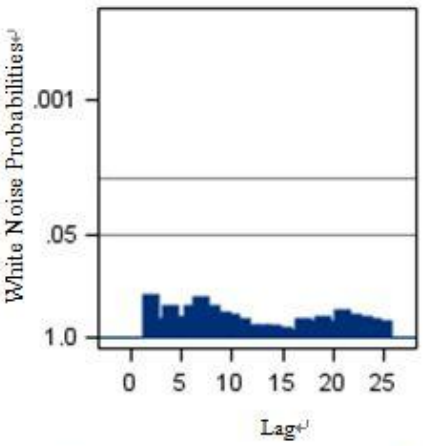
*The ADF test suggests rejection of the null hypothesis of a unit root, thus the idiosyncratic risk measure for the market-based intermediaries is stationary.

Panel B: Bayesian Information Criterion for Lag Length Selection

Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	-8.422	-8.653	-8.842	-8.952	-9.131	-9.174
AR 1	-9.296	-9.254	-9.243	-9.210	-9.194	-9.167
AR 2	-9.290	-9.261	-9.219	-9.182	-9.158	-9.134
AR 3	-9.254	-9.222	-9.179	-9.139	-9.116	-9.091
AR 4	-9.215	-9.187	-9.144	-9.101	-9.075	-9.051
AR 5	-9.206	-9.173	-9.130	-9.091	-9.049	-9.019

*According the BIC, the appropriate model fit for market-based intermediaries' idiosyncratic risk is an AR(1) model.

Panel C: White Noise Probabilities of the Residuals Following AR(1) Fit



*This graph indicates that the residuals from the AR(1) process exhibit white noise behavior suggesting a good model fit.

Panel D: Chow Tests for Structural Breaks

Quarter	F-Value	P-Value	
3/1/90	0.31	0.577	
6/1/90	0.40	0.526	
9/1/90	0.59	0.444	
12/1/90	0.79	0.377	
3/1/91	1.55	0.215	
6/1/91	2.67	0.105	
9/1/91	3.37	0.069	*
12/1/91	4.02	0.048	**
3/1/92	4.48	0.037	**
6/1/92	6.11	0.015	**
9/1/92	6.08	0.015	**
12/1/92	6.07	0.015	**
3/1/93	5.80	0.018	**
6/1/93	5.38	0.022	**
9/1/93	4.52	0.036	**
12/1/93	3.94	0.050	**
3/1/94	3.28	0.073	*
6/1/94	2.60	0.110	
9/1/94	1.98	0.162	
12/1/94	1.50	0.224	
3/1/95	1.10	0.297	
6/1/95	0.81	0.370	

*The Chow Tests suggest a structural break in the last quarter of 1991 (at the 5% signficance level).

Table A.2 Post ’91 Sample Competing Risks Model

Post '91 Sample	Traditional Intermediaries			Market-Based Intermediaries		
	Delisting: All	Delisting: Failure	Delisting: Merger	Delisting: All	Delisting: Failure	Delisting: Merger
Growth	-4.296 *** (0.000)	-2.524 (0.474)	-4.816 *** (0.000)	-0.825 * (0.059)	-0.586 (0.314)	-1.138 ** (0.043)
Profitability	0.009 (0.752)	-0.002 (0.964)	0.017 (0.533)	-0.002 (0.820)	-0.010 (0.379)	0.014 (0.413)
Excess Return	1.961 *** (0.000)	-0.834 (0.204)	2.634 *** (0.000)	0.048 (0.823)	-1.490 *** (0.001)	0.849 *** (0.000)
Relative Size	-0.129 ** (0.017)	-0.980 *** (0.000)	-0.016 (0.780)	-0.163 *** (0.000)	-0.642 *** (0.000)	-0.048 (0.327)
Idiosyncratic Risk	4.097 *** (0.006)	7.410 *** (0.002)	-0.148 (0.946)	2.653 ** (0.046)	9.251 *** (0.000)	-5.707 ** (0.038)
Number of Firms	462	462	462	264	264	264
Number of Firms with Event Occurrence	247	38	209	164	43	121

Notes:

1. Variable Definitions: Firm Growth = growth rate of total assets | Profitability = net income/total assets | Excess Return = difference between firm quarterly return and value-weighted return of all stocks listed on the NYSE/AMEX/Nasdaq as obtained from CRSP | Relative Size = ln(market value/market value of NYSE/AMEX/Nasdaq index) | Idiosyncratic Risk = squared residual from Fama and French (1993) model
2. 1%, 5%, 10% significance levels denoted ***, **, * respectively.
3. P-values are indicated in parenthesis.

Table A.3 Post ’91 Sample Competing Risks Model: Market Only Specification

Post '91 Sample	Traditional Intermediaries			Market-Based Intermediaries		
	Delisting: All	Delisting: Failure	Delisting: Merger	Delisting: All	Delisting: Failure	Delisting: Merger
Excess Return	1.341 *** (.000)	-0.964 ** (.040)	2.281 *** (.000)	-0.383 ** (.032)	-2.640 *** (.000)	0.934 *** (.000)
Relative Size	-0.182 *** (.000)	-1.116 *** (.000)	-0.049 (.215)	-0.160 *** (.000)	-0.644 *** (.000)	-0.019 (.617)
Idiosyncratic Risk	5.804 *** (.000)	7.483 *** (.000)	-2.095 (.316)	3.393 *** (.000)	5.381 *** (.000)	-7.292 *** (.001)
Number of Firms	947	947	947	490	490	490
Number of Firms with Event Occurrence	574	102	472	341	103	238

Notes:

1. Variable Definitions: Firm Growth = growth rate of total assets | Profitability = net income/total assets | Leverage Growth = growth rate of (total assets/total equity)| Excess Return = difference between firm quarterly return and value-weighted return of all stocks listed on the NYSE/AMEX/Nasdaq as obtained from CRSP | Relative Size = ln(market value/market value of NYSE/AMEX/Nasdaq index) | Idiosyncratic Risk = squared residual from Fama and French (1993) model
2. 1%, 5%, 10% significance levels denoted ***, **, * respectively.
3. P-values are indicated in parenthesis.