

## **Why Do Investment Banks Continue To Fail?**

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Economics Thesis Final Draft  
April 14, 2014

## **I. Introduction**

Financial crises are extremely costly from a monetary, social and psychological standpoint. In an attempt to quantify some of these costs, the Dallas Federal Reserve recently published estimates stating that the Great Recession may be responsible for output losses totaling between \$6 trillion and \$14 trillion (Atkinson). Output losses of this magnitude translate into about a \$50,000 to \$120,000 loss for every household. Whether the true costs of the recession fall at the lower or higher end of this sizeable range depends upon when or even if the economy will return to pre-crisis output levels. In addition to these monetary losses, unemployment numbers increased significantly, peaking at 10% in October 2009, and hovered around this level for several years. This metric represents further financial hardship for households as well as psychological repercussions on an individual level. Many of the repercussions are difficult to quantify, but statistics clearly show that financial meltdowns, like the Great Recession, have severe long-term consequences, which make it far too expensive for society to continue without better preventative policy measures in place. Analyzing past mistakes and historical events is one of the best tools available for determining effective policy and ensuring that financial crises are mitigated in the future.

Though it would be unfair to blame the entirety of past financial collapses on banks, they have historically played significant roles. The research of scholars including Ben Bernanke suggests that countries which experienced banking panics during the 1930s also suffered the worst depressions, demonstrating the impact that bank failure can have not only on aggregate output and shareholder wealth but also on overall economic efficiency (Bernanke 35). According to Bernanke, the most direct consequences of bank failure include increased cost of financial intermediation and decreased access to credit for companies and individuals alike (Bernanke 2).

Both of these consequences are apparent following the collapse of two influential investment banks, Caldwell and Company and Lehman Brothers, which failed during The Great Depression and The Great Recession respectively. These failures illustrate the mistakes that investment banks are prone to make and the ensuing repercussions. Such studies, in turn, can provide guidance for the development of appropriate regulation.

The most striking similarity between the two banks is the culture of greed that they both promoted. This common culture is primarily exemplified by their excessive risk-taking practices that ultimately caused their failures. In both cases, the banks rapidly expanded their balance sheets, increasing assets and debt obligations in large increments. The size of these companies' asset holdings alone is cause for concern especially when compared to their minimal equity holdings. The nature of their asset holdings is also a cause for concern. Both Caldwell and Company and Lehman preferred to invest in emerging markets and new financial products, which are inherently riskier and more unstable than well-established markets. However, larger returns compensate for the additional risk and instability associated with such markets, making them alluring to firms that are primarily focused on return. In order to implement such a return-centric culture, Caldwell and Company and Lehman Brothers endorsed a top-down management style that rewarded successful gambles rather than prudent risk management. Concentrating power amongst a few top executives resulted in questionable, even illegal business practices that crippled the firms when asset prices started to fall and revealed the balance sheet risk that both banks had actively endorsed during the profitable years.

## **II. A Brief History of Caldwell and Company**

When Caldwell and Company failed in 1930, it sparked a widespread financial collapse that permeated throughout much of the South, a feat that is hard to imagine given the company's

inauspicious beginnings. In 1917, Rogers Caldwell, a member of a well-respected Nashville family, started his own municipal bond house Caldwell and Company. His entry into the municipal market coincided with the U.S.'s entry into World War I, which meant that war bonds were flooding bond markets. The large demand for these war bonds, caused by an outpouring of patriotism, forced up yields on all other forms of bonds including municipal bonds. In other words, the popularity of war bonds came at the expense of other bonds, meaning Caldwell entered the municipal market at a very inopportune and uncertain time. In addition, southern municipal bonds had long been stigmatized due to a history of default (McFerrin 1). In spite of these problems that had all but suffocated the market for southern municipals, Caldwell, at the age of 27 with minimal experience in matters of finance, started a southern municipal bond house. Over the next 13 years, this seemingly ill-fated venture became the largest investment institution in Southern history (McFerrin 2). By the end of its fiscal year in 1929, assets under its control exceeded \$500 million (McFerrin 30), which is hard to imagine given that Caldwell and Company started with an initial capital stock of just \$100,000 fronted by Caldwell himself. Interestingly, Caldwell's decision to enter a risky market at an uncertain time coupled with his near total reliance on leverage led to his initial success and the rapid expansion of his firm. The most likely explanation as to how Caldwell overcame all odds in a short time is that he undertook an incredible amount of risk, investing in a wide array of speculative markets and leveraging up his company to imprudent levels. In doing so, Caldwell made his firm very susceptible to any market movement either positive or negative. As a result, the reasons for his successes also explain the bank's rapid descent into insolvency in late 1930.

Shortly after the end of World War I in 1918, Southern municipal bonds became an increasingly popular investment because the South was industrializing, translating into huge

economic growth across all business sectors. Comparatively, the North had already undergone industrialization, meaning there were fewer productive investment opportunities in the North thus freeing up capital to invest in Southern infrastructure projects. To facilitate the transition from agrarian to urban economy, Southern governments initiated a large number of public works projects that attracted the unused investment dollars (McFerrin 8). As one of the few banks that dared to specialize in Southern municipal bonds, Caldwell and Company benefited greatly from the relative attractiveness of this financial product. From 1918 to 1921, municipal bond issuances rose from \$297 million to \$1.2 billion with an increasingly large portion of these issuances (between 25% and 30%) going to the South to finance ongoing public projects (McFerrin 8). Caldwell and Company concentrated especially on municipal bonds from Tennessee, Alabama, Louisiana and Florida. Without war bonds over-saturating the market and with productive investment opportunities assuaging fears of default, the large yield premiums on Southern municipal bonds were no longer necessary to attract money to the South. Accordingly, premiums dropped. In this way, Rogers' first gamble in the Southern Municipal bond market became an unbelievable success. However, the dropping yield premiums also meant that he had to look to other markets for big return margins.

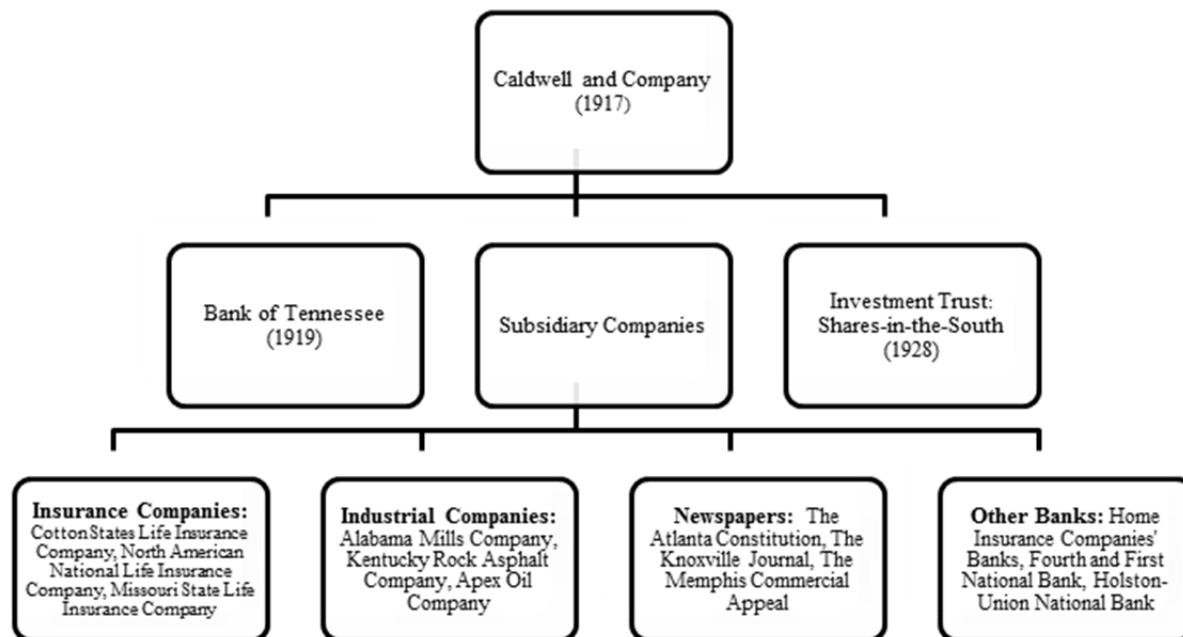
In order to finance expansion into markets outside of the municipal bond market, Caldwell and Company had to build out the liability side of its balance sheet. Caldwell preferred to use leverage rather than issue more stock and dilute his sole ownership of the company. In 1919, Caldwell created a depository institution called The Bank of Tennessee in order to amass debt, obtain capital, and eventually shield some of its more questionable business practices from the public eye. Its creation was one of Caldwell's most critical and controversial tactics. The Bank's primary purpose was to provide Caldwell and Company with a place to deposit the

money it made from bond sales (McFerrin 6). Despite being a depository institution, the Bank of Tennessee was unique in that it had no individual deposit customers. Instead, it served exclusively as a depository for municipalities and companies financed by Caldwell and Company (Wicker 33). For all intents and purposes, these two institutions were the exact same, even occupying the same offices and employing the same staff (McFerrin 6). However, Caldwell and Company advertised the Bank of Tennessee as a separate institution entirely. There was one key difference between the parent company and its subsidiary: the Bank of Tennessee was subject to regulation by the Tennessee Department of Banking whereas Caldwell and Company did not directly report to any regulatory agency. Though a seemingly important difference, the relaxed approach to regulation that characterized the 1920s meant that in actuality the business practices of both institutions frequently escaped notice.

With the Bank of Tennessee providing access to cash and with some excess working capital from its successes in the Southern municipal market, Caldwell expanded his firm's scope, entering other emerging and unstable markets. As early as 1923, the company started to invest in real estate, a market that evolved shortly after World War I. So, the market was new and highly unregulated when Caldwell started to invest company resources and money (McFerrin 18). Caldwell and Company was far from the only investment house to recognize the potential of the real estate market. From 1921 to 1929, loans issued on real estate increased by 179% (Wicker 16). As a result, the real estate asset bubble burgeoned over the next few years especially in the rapidly developing South. Early investors like Caldwell and Company enjoyed high returns. That is until the market collapsed in 1926 a couple of years before the stock bubble burst (McFerrin 15). Adding to the already inherently speculative nature of real estate, Caldwell had almost no experience in the industry. He became heavily involved nonetheless prompted by large returns

that ranged between 8 and 10 basis points for every issuance of real estate mortgage securities (McFerrin 20). By 1925, Caldwell and Company had issued a total of \$1 billion in real estate mortgage bonds on a variety of buildings including hotels, apartments, hospitals, office buildings and colleges (McFerrin 18). Next, Caldwell delved into industrial securities, an especially hot market given the ongoing industrialization of the South. Between 1926 and 1929, Caldwell and Company underwrote 24 issuances for companies in industries such as textile and clothing mills, mines and distribution (McFerrin 37), earning about 10 basis points in spread for each issuance (McFerrin 46). In addition to underwriting and origination, Caldwell also decided to purchase controlling interests in a number of industrial companies, in spite of his profound lack of experience in managing companies such as these. In the end, Caldwell and Company had control over industrial assets exceeding \$40 million, giving it a considerable amount of power and influence over Southern industry (McFerrin 47). By acquiring businesses as opposed to just investing in them, Caldwell and Company could mandate that their subsidiaries deposit all cash reserves with the Bank of Tennessee thereby increasing its access to highly liquid funds with which to invest. These funds then enabled Caldwell and Company seek out other developing, high-growth markets, a strategy that had served them well at least initially.

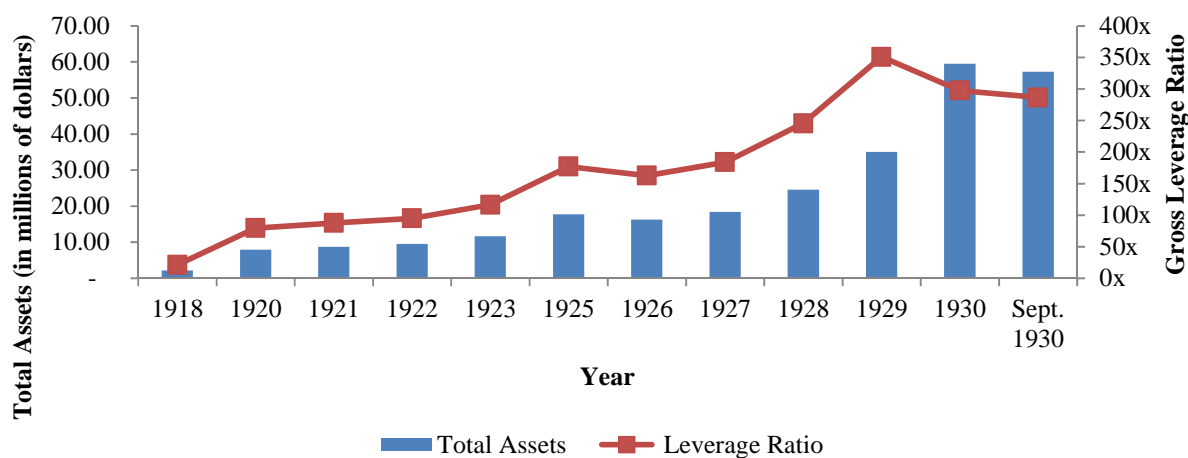
To further increase deposits, Caldwell and Company purchased controlling interests in several insurance companies, other banks and newspapers such that by the end of its fiscal year in 1929, it had an estimated \$450 million of assets under its control (McFerrin 117). After 12 years of acquisitions and rapid growth, the structure of Caldwell and Company had expanded to look something like this chart:



In 1925, deposits coming primarily from these companies peaked at \$12.5 million and continued to hover around \$10 million for the next 5 years (McFerrin 12). These deposits were then used as working capital to expand the investment house, furnishing between 50% and 70% of Caldwell and Company's funds between 1918 and 1926 (McFerrin 13). In the meantime, opportunities for investing and originating securities started to decline sharply. From 1926 to 1929, Caldwell and Company only underwrote a total of 24 security issuances. Despite declining market activity, Caldwell and Company continued to invest profligately, increasing total assets to \$500 million a far cry from the mere \$2.2 million of assets it held in December 1918 (McFerrin 30). To better show the large-scale expansion of the firm, asset growth is compared to leverage growth in the following graph:



## Caldwell and Company Asset and Leverage Growth



By increasing asset holding such a remarkable amount and allowing them to proliferate so extensively across many industries and financial products, Caldwell and Company transformed itself into the staple financial institution in the South. In addition to financial power, the company also amassed considerable political power throughout its history. Given that it sold municipal bonds and frequently dealt with governments, Caldwell and Company was well-positioned to enter the political sphere (McFerrin 99). Also, Rogers Caldwell had a personal relationship with Tennessee congressman Luke Lea, who owned the Nashville *Tennessean*. Because of this friendship and Lea's ties to the newspaper industry, Caldwell and Company came to control several large Southern newspapers, which provided it with a good deal of political sway and control over the media. By 1929, due to its pervasive economic and political influence, this small municipal bond house had become an integral fixture of the South.

Aside from lack of experience, the problem with acquiring companies as opposed to investing in their financial products is that companies are highly illiquid and non-marketable. In fact, throughout Caldwell and Company's short history, total assets were primarily comprised of non-liquid securities whereas cash accounted for a mere 5.5% of total assets at best (McFerrin

30). To make matters worse, Caldwell and Company had almost no permanent capital to support its balance sheet. Instead, it relied completely on outside sources to provide funding. Cash typically made up between 1% and 5% of total liabilities and usually fell significantly below the legally mandated 10% of deposits for the Bank of Tennessee (McFerrin 30). By 1929, the majority of its liabilities were in the form of demand deposits held at the Bank of Tennessee, demand loans and demand liabilities on repurchase agreements, all of which could be called by creditors at any time. Thus, the company's future was at the whim of its creditors. Unwilling to curtail his aggressive investment strategy or dilute his sole ownership position through capital raises, Caldwell maintained the high leverage. He obtained loans even if it meant violating regulations or laws. To ensure creditors would not recall their loans and ruin his empire, Caldwell had to convince creditors of his firm's financial well-being. To do so, Caldwell and Company in engaged in unethical and even illegal activities often using the Bank of Tennessee to shield these practices from public scrutiny.

There are numerous examples of these questionable business practices. One of the more benign practices was the artificial inflation of asset prices made possible in part by ensuring that the accounting department remained in a perpetual state of disorder. To create price inflation, Caldwell and Company and the Bank of Tennessee traded securities back and forth raising the value of the asset with each trade, adding as much as \$6.9 million to the book value of Caldwell's asset holdings (McFerrin 139). Additionally, the Bank of Tennessee allowed Caldwell and Company to function as a market maker. Caldwell and Company would sell securities that it originated to its subsidiary to make it appear as though there was a large demand and drive up prices. But perhaps most concerning, Caldwell and Company outright violated nearly half of its trust agreements (McFerrin 144), which was illegal. It was possible nevertheless

because the Bank of Tennessee usually served as the trustee for Caldwell and Company and vice versa (McFerrin 13). As long as the securities on the books were valued at high prices and could be easily marketed to investors, what served as collateral and the means of obtaining funding were all but irrelevant. However, overinvestment meant that Caldwell and Company by the end of 1929 was in such a precarious position that any net withdrawal could have crippled the bank, which was becoming more and more probable as public confidence declined in the wake of the stock market crash.

In spite of a poor accounting department and lax regulation standards, investors were warned prior to 1929 about Caldwell and Company's suspicious behavior. As early as 1926, auditors began to point out the many inconsistencies within company books (McFerrin 4). Eventually, the Tennessee Department of Banking, which oversaw depository institutions like the Bank of Tennessee, also became aware of these suspect practices. Despite the concern expressed by the banking department as well as auditors, the Bank of Tennessee became a state depository in 1927 (McFerrin 113). Ignoring these warnings ultimately cost the state of Tennessee about \$3.4 million in deposits when the bank closed in 1930 (McFerrin 162). The state of Tennessee was one of many investors that dismissed the reasonable concerns of regulators, choosing to trust the appearances that Caldwell so carefully maintained using the Bank of Tennessee. As a result, Caldwell and Company was able to grow for years in spite of having insufficient funds and being grossly undercapitalized.

While the public remained ignorant, Rogers Caldwell finally recognized the dire position of his company. In an effort to improve the financial health of Caldwell and Company, he negotiated a merger with BancoKentucky in May of 1930 (McFerrin 134), creating what the *Herald-Post* deemed "by far the most important financial structure ever built in the Middle

Western or Southern States and one that will undoubtedly stand out in the future as one of America's greatest financial institutions" (McFerrin 136). The Atlanta Journal Constitution reported that after the merger the combined institution had assets of \$615 million with a capital surplus of \$100,000 (Caldwell Company in Huge Alliance 1). These estimates soon proved to be overly optimistic to say the least. Thanks to relaxed regulations of the time especially for non-depository institutions, Caldwell managed to execute the merger without ever having to expose his books. However, PricewaterhouseCoopers, which performed an audit in May 1930 after the merger occurred, asserted that at the time of the merger Caldwell and Company was insolvent with assets totaling \$37 million and current liabilities easily exceeding \$38 million (McFerrin 140). Ironically, BancoKentucky was also in distress at the time of the merger and was largely unable to provide Caldwell and Company with the stability it desperately needed (McFerrin 136-137). At the end of its fiscal year in 1930, Caldwell and Company could no longer maintain appearances of solvency and reported a preliminary net loss of \$2.5 million bringing the company under scrutiny from the public as well as the Federal Reserve.

In September of 1930, bank examiners were brought in to evaluate the financial health of the Bank of Tennessee and discovered that its cash reserves were far below the legal minimum. This depletion of cash reserves was the result of Caldwell and Company borrowing excessively in order to meet immediate liquidity demands caused by suffering markets. Despite the examiners' findings, the Bank of Tennessee continued to function for another two months. On November 5, Caldwell and Company met with the Nashville Clearing House while the Atlanta Federal Reserve appointed a committee to quietly examine Caldwell and Company's financial health (McFerrin 177). Caldwell tried to use his political power to influence which candidates were elected to this committee. However, Caldwell and Company could not delay the inevitable.

That same day, the committee called the Tennessee superintendent to re-examine the Bank of Tennessee. In the midst of these hectic events preceding bankruptcy, *The Wall Street Journal* ran an article on November 6, 1930 declaring ““all loans of Caldwell & Co. amply secured and the company in a solvent position”” (Caldwell & Co. Is Reported Solvent, 1). The following day, the superintendent officially declared the Bank of Tennessee insolvent and filed a report with the Chancery Court (McFerrin 178). Finally, on November 14, Caldwell and Company went into receivership (McFerrin 178) followed closely by Banco Kentucky at the end of the month. Caldwell and Company’s failure was felt throughout the South as all banks and companies bearing any association collapsed in succession. In fact, economist Elmus Wicker attributes over one-half of Southern bank failures occurring in November of 1930, the first month of the first Great Depression banking crisis, to the collapse of Caldwell and Company (Wicker 29). Because Caldwell and Company had such a complex and extensive network that crossed a number of state lines, its failure introduced uncertainty and distrust into the entire network causing the whole thing to collapse (Wicker 35).

The rapid expansion of Caldwell and Company’s balance sheet, made possible by speculation, leverage and unethical business practices, clearly shows that the company’s failure was not simply a product of the external environment. Certainly, the company prospered during the roaring 1920s and collapsed alongside many other similar institutions during the worst economic downturn in history. This pro-cyclicality is typical of most firms especially those with high leverage because leverage is pro-cyclical by nature, meaning it exacerbates both the highs and lows of an economic cycle. Caldwell and Company’s management deliberately increased leverage to unsustainable levels thereby making the company more susceptible to any adverse market movement both beneficial and adverse. This conscious business decision suggests that

Caldwell and Company was hardly just a victim of unforeseen, unprecedented market dislocation. Economic booms exacerbated by periods of relaxed regulation require banks to exercise self-restraint and forethought. Caldwell and Company, like many other banks, abandoned caution, capitalized on the absence of regulation and adopted a short-term, aggressive investment strategy that was inevitably accompanied by high risk.

Leading the charge was Rogers Caldwell. As his company expanded, Caldwell refused to delegate authority and remained the sole stockholder, eliminating any sort of checks and balance system that might mitigate against his speculative and greedy management style. For example, Caldwell and Company never held board meetings and often just made up minutes (McFerrin 35). Without other executives to contest his authority or assuage his greed, Rogers Caldwell was free to pursue profit at all cost, entering poorly understood industries and investing unreservedly in a suite of risky financial products. Even more problematic, he endorsed business practices such as trust agreement violation and the intentional understaffing of his accounting department, both of which clearly breached ethical conventions and laws. Caldwell's greed-centric attitude and his uncontested authority helped him to convince his employees as well as investors that Caldwell and Company was invincible. With this mentality, Caldwell and Company led by Caldwell endorsed a strategy driven by greed with limited regard for reason or caution. As Wicker puts it: "[...] the failure of Caldwell and Co. and its many affiliates revealed that questionable managerial and financial practices inaugurated in the twenties to foster rapid growth and expansion explain the firm's demise" (Wicker 36). Because of Caldwell's suspect business practices and ethics, the South endured a banking crisis that in many ways helped instigate an unprecedented economic depression.

The collapse of Caldwell and Company severely damaged consumer confidence, raised the cost of financial intermediation and created large financial losses for many Southern firms and states. That is all to say, Caldwell and Company played a significant role in the depressed economic conditions of the South during the early 1930s. However, macroeconomic factors also had a significant impact on the financial environment. Though macroeconomists cite many reasons and nuances when enumerating the causes of the Great Depression, central banks' contractionary policy during a time that demanded expansionary policy and inflation has received a lot of attention. Economists Barry Eichengreen and Peter Temin go even further to suggest that the inappropriate response of central banks internationally stemmed from their strict adherence to the Gold Standard and maintaining a fixed exchange rate system. Eichengreen and Temin explain the system: "The gold standard was characterized by the free flow of gold between individuals and countries, the maintenance of fixed values of national currencies in terms of gold and therefore each other, and the absence of an international coordinating organization" (Eichengreen 2). In order to maintain the relative strength of a currency on the international market, domestic prices had to fluctuate accordingly, which meant that deflation was necessary to avoid devaluation. In addition to deflation, countries on the gold standard attempting to stave off deflation could not allow the demand for exports to determine their exchange rate or expand their money supply to stimulate domestic demand because both of those would push up prices, provoke gold exports and weaken the currency (Eichengreen 10). Applying this theory to the events of the Great Depression demonstrates that central banks such as the Federal Reserve were extremely limited in their ability to correct deflation through expansionary policy measures if they were to maintain the strength of the dollar, which they believed would eventually restore output and employment back to healthy levels anyway.

Because the Federal Reserve was contracting money supply and tightening lending standards, banks like Caldwell and Company were denied access to emergency liquidity and failed, worsening the overall economic conditions. The risk that Caldwell and Company acquired through imprudent and at times unethical ways was responsible for the creation of serious economic problems, but it should be noted that all of this occurred within a broader context in which the Federal Reserve in the 1930s chose to maintain the value of the dollar instead of providing much-needed liquidity to banks.

### **III. A Brief History of Lehman Brothers**

Because the collapse of Caldwell and Company had such severe and widespread consequences, it is hard to imagine how investment banks within a matter of decades could forget the lessons of the Great Depression and allow greed to once again dictate decision-making. And yet that is exactly what occurred. Within a couple of generations, investment houses had already shifted their attention back to profits. What should have been a cruel lesson in moderation and prudence was brushed aside as shareholders and bankers alike clamored for big returns. To make matters worse, the government actually facilitated this return to greed by relaxing regulations. Most importantly, in 1999, the government did away with the remaining elements of the Glass-Steagall Act, implemented after the Great Depression to ensure that history, in particular banking history, did not repeat itself. More specifically, this act was intended to create a firewall between commercial and investment banks, drawing several clear-cut distinctions. Essentially, it contained four provisions, which limited commercial banks to very narrowly-defined investment activities and prohibited investment banks from accepting deposits. However, this piece of legislation was seen as impeding economic development and so congress repealed it in 1999. Then-Treasury Secretary Lawrence Summers applauded Congress'



decision to repeal Glass-Steagall, saying: ““Today, Congress voted to update the rules that have governed financial services since the Great Depression and replace them with a system for the 21st century. This historic legislation will better enable American companies to compete in the new economy”” (Sanati). Without these restrictions in place, banks were once again free to expand without limits and take huge gambles with shareholder money. And once again shareholders and banks paid heavily for their excessive risk-taking behavior.

In 2008, Lehman Brothers went down in infamy for its pivotal role in instigating the Great Recession. Prior to 2008, this investment bank had a history of bouncing back from economic hardship with even larger profit margins and stronger returns on investment (Tibman 9). One Lehman Brothers banker describes the company’s resilience to hardship, saying: “Our stock price, again and again, hit stratospheric new highs, driven by the only occasionally interrupted momentum of our surging performance. We became, in our minds, invincible. We were Lehman. The Brothers. In hindsight, we were also like a teenager who believes he will live forever” (Tibman 10). This statement captures the hubris that had become an integral part of Lehman culture. Like all tragic flaws, this hubris and sense of invincibility eventually led to failure. This mentality encouraged management to use unreasonably risky methods in order to grow the company past a sustainable point, just as Rogers Caldwell had done 80 years before. Failing to learn from history, at 1:45AM on September 15, 2008, Lehman Brothers filed for Chapter 11 – complete liquidation of the firm (Tibman 2). The iconic green letters that had towered over Times Square for years were removed, signifying the first-time in its 160-year history that Lehman could not recover from its losses and prompting a widespread loss of confidence felt throughout the United States.

Many times before 2008, Lehman Brothers had found itself on the brink of failure as a result of its yield-seeking strategy. Each of these prior instances should have served as warnings against such imprudent behavior. Unfortunately, much like the lessons of the Great Depression, they were ignored largely because Lehman often escaped these brushes with bankruptcy without facing any real repercussions. Despite the odds, Lehman continually managed to emerge from financial hardships even stronger than before, perpetuating this illusion that Lehman was indestructible. Like Caldwell and Company, Lehman began as a Southern institution headquartered in Montgomery, Alabama. In 1848, it operated as a dry goods store with no obvious ties to the finance world. Within 15 years of its founding, the Civil War started and presented Lehman with its first potentially ruinous challenge. However, the small firm survived the hardship and rebuilt after the war with its primary change being its relocation to New York. To help bring in revenue, Lehman expanded into the commodities future business. It helped create the New York Cotton Exchange and other important commodity exchanges. Relying on management's creativity and adaptability, Lehman not only survived the difficult post-Civil War era but also managed to transform itself into a preeminent financial firm.

Well-established as an investment firm, Lehman, like Caldwell, looked for other emerging markets and high-growth industries in which to invest. In 1906, Lehman partnered with Goldman Sachs to finance the development of the retail sector. As a part of this project, the two firms served as joint bookrunners on security issuances for big name companies including Sears, F.W. Woolworth, Gimbel Brothers and R.H. Macy & Co. (Harvard Business School). In addition to retail, Lehman was an early investor in airlines and motion pictures. For the most part, these risky forays into new industries paid off. These successes, in part, sustained Lehman through the Great Depression. However, like all firms, it suffered from the depressed economic

activity. As was the case with the commodities exchanges in the post-Civil War era, it was a stroke of creative ingenuity that saved the company from suffering a similar fate as Caldwell and Company. In 1930, Lehman Brothers developed private placements, which provided an alternative way for Blue Chip companies to secure funding at a time when struggling financial markets were unreceptive to new issuances. Interestingly, private placements were not public due to the fact that they were not actually sanctioned by the SEC until the Exchange Act in 1934. Nevertheless, this inventiveness helped Lehman to generate enough profit to offset its exuberance in markets that had collapsed while also helping these large, staple companies to continue conducting business.

Again, in 1984, Lehman was almost forced into bankruptcy after sustaining significant trading losses. At this precarious time, one trader Dick Fuld, incidentally the trader that led Lehman into bankruptcy in 2008, placed an enormous bet that interest rates would fall. Inexplicably, he clung to this decision long after interest rates started to rise, amassing losses of around \$30 million incurred within a single financial quarter (Tibman 28). No longer financially sound as an independent company, Lehman had to broker a fire-sale deal with American Express in order to save the firm from bankruptcy. In 1994 when American Express spun-off Lehman, Dick Fuld, the man who in many ways created the need for the merger in the first place, was named the new CEO (Tibman 32). Lehman's history is riddled with many other instances of overly risky investment strategies ending in near-failure, but each time Lehman managed to find a way to extract itself from the situation.

That is until 2008 when Lehman gambled and suffered net losses of \$2.8 billion and \$3.9 billion respectively in its final two quarters. These losses were attributable primarily to heavy write downs on investments in very risky, unstable markets, most notably the subprime market.

For comparison, Lehman's capital to asset ratio at the time was around 4.1%, a slight increase from previous years but not significant enough to absorb such large quarterly losses. As Bernanke explains: "In the case of Lehman Brothers, there was just a huge hole. I mean, they were insolvent and they had a 30- to 40-billion-dollar hole in their capital structure" (Eavis). Unlike in the 1930s when it was restricted by the gold standard, the Federal Reserve had the ability to save Lehman Brothers, but as Bernanke indicates, they ultimately decided that the company was too expensive to save. And so it was allowed to fail, igniting a larger global meltdown.

The causes of Lehman's failure closely mirror those discussed in regards to Caldwell and Company's failure. Though Lehman had a 160-year history (in comparison to Caldwell's 13-year history) from which to learn the importance of risk management, it opted for a similar profit-maximizing investment approach. In 2006, Lehman adopted a very aggressive growth strategy, insisting on 13% growth in revenues year-over-year. Firm leaders expected to accomplish this goal by rapidly expanding the firm's balance sheet, capital base and risk appetite (Field 1). Explicitly emphasizing profits over risk management captures the mentality of greed that Lehman promoted and rewarded. Even though risk and return must be managed jointly, Lehman focused only on the latter with little regard for the former. This culture inevitably encouraged highly risky investments, which promised huge returns as long as the market continued to perform well.

As was the case with Caldwell, seeking big returns led Lehman to vastly overinvest in poorly understood, opaque markets. By the end of 2007, Lehman had an unprecedented \$32.6 billion in real estate assets on its books comprised mostly of Mortgage-Backed Securities, commercial real estate assets and Credit Default Swaps (Frangos 1). With the exception of Bear

Stearns, Lehman held the largest amount of real estate assets of any investment bank (Tibman 86). Lehman's large-scale participation in the MBS market is to some degree understandable given that it had historically specialized in fixed-income securities. However, the company surpassed a level of exposure in which return could justify the enormous risk consideration associated with these assets. Initially, while housing prices were soaring seemingly without limits, this risk associated with MBSs, particularly subprime MBSs, appeared all but inconsequential when compared to the huge returns on these products. For a time the high returns combined with large investment in these securities significantly increased the value of the firm. From 2000 until 2006, Lehman's stock price outperformed all other competitors, increasing by 349% over those 6 years. By comparison, Bear Stearns had the next best performance with an increase of 316% over the same time period. Importantly, Goldman Sachs, which survived the Great Recession intact, experienced an increase of only 158% in its stock price (Harris 4). Despite being less than half of that of Lehman, Goldman's stock performance was the best of any bank still in existence post-2009. The large gap in stock price performance suggests that being pioneers and heavy investors in very risky markets can pay off handsomely while the market is hot, translating into large profits and equally large bonuses.

When the real estate market started to soften in 2006, Lehman, at the command of senior leadership, actually increased its exposure to both commercial real estate and Alt-A loans, which are mortgage loans to homeowners who lack definitive proof of an income (Tibman 85). Alt-A loans, in particular, are extremely risky investments even when the market is strong, calling into question Lehman's rationale for accumulating more of these assets. Adding to its stockpile of intrinsically risky real estate assets, in October 2007 Lehman entered into a \$22 billion joint-venture to purchase Archstone Smith Trust, a real estate investment trust. This venture added \$12

billion of commercial real estate loans to Lehman's already extensive holdings (Tibman 87). It is hard to fathom how Lehman could possibly rationalize taking on this much risk at such a precarious time. Anton Valukas, a bank examiner asked to investigate Lehman's failure for Bankruptcy Court, attempted to explain this unjustifiable investment by revealing that Lehman's management never performed a "quantitative analysis of the risks Archstone entailed or on their impact on Lehman, even though it was clear from the outset that it would cause the firm to exceed its risk limits" (Field 1). As an internal control designed to manage risk, Lehman set risk limits for the entire firm as well as for individual transactions. Projected potential losses were not to exceed these limits. Thus, for Archstone to exceed Lehman's risk limits is highly suggestive since management had already almost doubled firm-wide risk tolerance from \$2.3 billion to \$4 billion (Field 1). The firm's reckless insistence on making more money trivialized the costly nature of revenue, leading to poor investment decisions such as the purchase of Archstone. Though larger than most bad transactions, the Archstone example illustrates how Lehman accumulated so many highly illiquid assets and depleted its capital surplus. Once artificially inflated asset values collapsed, these decisions eventually crippled the firm.

While Lehman added about \$300 billion in assets to its books from 2004 to 2007, it only increased equity by a fractional amount. Capital raises during this same timeframe totaled about \$6 billion (Tully 1), meaning Lehman had to amass a massive amount of debt to bridge this immense gap between assets and capital. Because it had so little capital with which to absorb losses, Lehman could withstand about a 3% loss on its assets before shareholder equity would be extinguished. A loss of this amount would not be unusual under normal economic conditions. To make its leverage situation even more precarious, Lehman used primarily short-term debt to finance its investment activity, introducing a time inconsistency problem in addition to

overleveraging (Tully 1). Mortgage-Backed Securities, which made up a very significant portion of Lehman's portfolio, typically had long-term payment schedules because mortgages provided the underlying stream of revenue, and they are structured for the long-term. As the name implies, short-term debt must be paid back in the short-run, conventionally within a year. Thus, the timing of Lehman's revenue inflow and cost outflow were extremely mismatched. As was the case with Caldwell and Company, the excessive leverage and timing inconsistency could be kept hidden from creditors, stockholders and employees alike while asset prices and subsequently the firm's value continued to increase. The problem arises once the asset bubble bursts, and nervous creditors demand to be paid rather than simply renewing loans on good faith. In that case, long-term revenue streams make it very hard to obtain access to cash quickly, forcing companies like Lehman to default on its obligations. This exact issue occurred on June 9, 2008 when, for the first time in its history as a public company, Lehman posted a quarterly net loss. This loss amounted to \$2.8 billion, 4 times worse than the most pessimistic analyst forecast (Tibman 147). Concerned by a loss of this size, JP Morgan, Lehman's primary financier, demanded more collateral before it would issue more commercial paper, but Lehman did not have access to the necessary collateral. In response, JP Morgan discontinued its loans. From this point onwards, Lehman descended rapidly into insolvency. Eventually, Lehman was forced to file for complete liquidation of the firm after CEO Dick Fuld failed to negotiate a fire-sale deal with another financial institution. With the government also refusing to provide monetary assistance, the company was unable to pay its debts and failed shortly thereafter. At least for now, Lehman serves as a warning against the use of excessive leverage to finance large-scale investments in risky, illiquid assets.

Much like Caldwell and Company, the decision to expand its leverage to inadvisable levels in order to finance its excessively risky investments came from the obstinacy of its leadership. For most of his tenure as CEO of Lehman, the press praised Dick Fuld as one of America's most effective CEOs (Tibman 36). He transformed Lehman into one of the preeminent investment banking houses, growing return on equity from a mere 2.2% in 1994 to an astounding 19.4% in 2005 and raising stock price by an average of 29% each year (Serwer 1). Over that same 11-year period, Lehman increased earnings from about \$75 million to \$3.2 billion. Though he lacked the eloquence and public speaking abilities of other Fortune 500 CEOs, Fuld managed to transform the company by overcoming a history of internal division and creating "one of the best cultures on Wall Street" (Worthington 2). In particular, he garnered a lot of respect both within the firm and from the public in the wake of September 11<sup>th</sup>. On 9/11, Lehman's offices in the World Trade Center were reduced to rubble, leaving its employees traumatized. Even so, Fuld used this horrific event to unite and even grow the company (Tibman 45). Though employees had to conduct business out of a hotel for months, the firm far outperformed competition that year (Tibman 47). Fuld's response to the devastating events of 9/11 proved his capabilities as a leader and his unrelenting drive to make Lehman a major competitor on Wall Street. As CEO and the lifeblood of the company, Fuld received a lot of the praise for Lehman's unprecedented growth story just as he received the brunt of the blame after he led the company into bankruptcy. In the end, Fuld's ego and "the nearly universal acclaim he received as a master CEO blinded him, so that he believed there was no hole out of which he could not dig himself, i.e., his company" (Tibman 53). After the market crashed and wreaked havoc on the Lehman balance sheet, his hubris actually deepened the hole instead of helping him and his firm recover from the mistakes which he had made.



After developing the company, Fuld should have delegated some of his power to other senior level executives. He could not single-handedly manage a firm bringing in annual revenues of \$47 billion (in 2007). Instead, much like Rogers Caldwell, Fuld retained near dictatorial control of Lehman, trusting only a few advisors with any real power. In addition to not entrusting others with power, Fuld made it well-known within the company that he found dissent unproductive (Tibman 52). Fuld's "number two," Joe Gregory, was one of his trusted few and was one of the most insistent about pursuing an aggressive real estate investment strategy. When the head of Lehman's Fixed Income department Michael Gelband tried to warn executives of the irresponsible overinvestment in real estate, Joe Gregory had him fired with Fuld's consent. Gelband was not an isolated incident. Madelyn Antoncic, the head of risk management, also tried to intervene and induce management to hedge or divest from some of its riskier mortgage assets. Shortly thereafter she was forced to give up her position as head of Risk Management and accept some meaningless, obscure position within the company (Tibman 121). As Gelband and Antoncic show, Fuld and Gregory did not allow anyone to contest their authority especially when it came to their over-involvement in the real estate market.

Because Fuld refused to relinquish control, he was able to mislead his employees about the actual financial well-being of the company. The extent to which Lehman over-leveraged its balance sheet and accumulated unsafe assets was not well-known even within the firm. Fuld's empty promises of the firm's financial security disillusioned employees as much as they did financial analysts and stockholders. In fact, most Lehman employees genuinely believed that because of the firm's tumultuous history that included several near-bankruptcy experiences, the company was extremely risk averse in comparison to competitors (Tibman 51). Employees were also overconfident in Lehman Brother's invincibility after these brushes with bankruptcy, an

attitude that they adopted from Fuld. So when Lehman shed \$147 billion, or 19%, of its gross assets during the second quarter of 2008, most observers accepted it as sufficient progress towards righting its balance sheet (Pinschmidt 4). Morgan Stanley analyst Patrick Pinschmidt continued to believe as late as June 2008 that the company had “sufficient capital to absorb the downside risk” (Pinschmidt 1). Because executives could not contest Fuld’s decisions and employees blindly trusted their celebrated leader, Fuld was free to over leverage his firm and invest in toxic assets even though he was condemning Lehman to failure much like Caldwell did to his firm decades before.

Fuld and Caldwell both relied on their confidence, aggression and greed to turn their respective companies into newsworthy success stories. These same traits also led to the excess that caused their ultimate demise. An insatiable appetite for profit is an implicit requirement for Wall Street CEOs, but when left unchecked this appetite can spawn “a long history of derailment when all reason goes out the window, with dealmakers then raging at full speed, like a locomotive at full throttle, with disabled brakes” (Tibman 108). Fuld and Caldwell both suffered this fate, dragging their unsuspecting firms with them. The extreme hierarchical structure of the two companies meant that as CEOs, Fuld and Caldwell could readily endorse a strategy of greed that centered on entering into poorly understood, high-yield markets while simultaneously unrestrainedly increasing leverage ratios. It also meant that when returns dissipated along with shareholder money, Fuld and Caldwell were saddled with most of the blame.

#### **IV. Quantitative Analysis**

##### *Introduction*

Comparing the history of Caldwell and Company to that of Lehman Brothers reveals several recurring business practices, namely the overexpansion of the balance sheet and the

eagerness to be financial innovators, that contributed greatly to the collapse of each institution. In this way, qualitative analysis helps to identify the mistakes repeated over the course history thereby identifying in a more subjective way reasons why investment banks continue to fail. The issue then becomes how to prevent other investment institutions from making these same mistakes. Certain mathematical models, for instance, can quantify the risky behavior of banks by quantifying the risk on a bank's balance sheet. If these models are well-formulated and effective, then regulatory agencies can use them to recognize problems and stop such behavior from contributing to a complete financial meltdown. Models, like the Value-at-Risk model, show that Lehman's imprudent, large-scale investments in very risky assets exposed the firm to huge losses when asset prices started to fall. Its balance sheet could not possibly absorb such losses, meaning the signs of insolvency were present within Lehman's books long before 2008. At the time, regulatory agencies let firms carry out their own risk management, so Lehman executives, concerned primarily with the size of their next bonus, used this freedom to disregard warning signs and focus solely on return.

Though they were often disregarded and rarely exerted any influence over decision-making, Lehman, like all firms, did have some internal risk management procedures in place before the crisis. Since the 1990s, the industry standard for investment banks to determine portfolio risk has been the Value-at-Risk (VaR) method (NYU Stern School 4). This model measures how much a portfolio stands to lose at a certain confidence level over a set time horizon (NYU Stern School 1). In other words, Value-at-Risk estimates the *maximum* amount the firm would expect to lose on its portfolio in one period. There are several different methods for actually calculating Value-at-Risk, including the analytical method, the historical simulation and the Monte Carlo simulation, each of which has a unique set of advantages and disadvantages

(NYU Stern School 4). Regardless of which type is used, Value-at-Risk is an internal process that does not consider the impact of external macroeconomic adverse shocks. Though other stress tests use externalities to drive its model, Matthew Pritsker (2011), a member of the Federal Reserve's Risk and Policy Analysis unit, actually advocates for a maximum-loss model, like the Value-at-Risk model. He argues that banks' risk exposure to certain financial products had a larger impact than macroeconomic events in causing the 2008 financial meltdown (Pritsker 3). In his publication, Pritsker constructs an alternative way for measuring the worst linear loss on a given portfolio, but similar logic underlies the Value-at-Risk approach. Still widely used by investment banks, the Value-at-Risk method provides firms with a credible means for measuring the worst-case scenario loss on a specific portfolio. However, like all tests, the Value-at-Risk model has limitations. For example, its dependence on historical asset prices limits the test's ability to predict maximum loss in the event of a severe market dislocation. Such limitations reiterate the need for additional regulation as well as other internal risk management controls. Nevertheless, the Value-at-Risk model provides a pretty good estimate of the riskiness of firms like Lehman Brothers.

### *Data*

In order to apply the Value-at-Risk model, access to balance sheet data is needed. I had hoped to collect the necessary data for the Bank of Tennessee and use it as a proxy for the non-public Caldwell and Company. However, the available data was too incomplete to yield accurate and consistent results. Because the Bank of Tennessee was a depository institution, it was subject to regulation by the state Banking Department. Though regulatory standards were lax at the time, documents assessing the financial health of the bank were filed annually. Currently, they are held

on microfilm at the Tennessee Archives. These reports contain a list of outstanding loans as well as a list of financial securities being held under the Bank of Tennessee name. I had hoped to use this break-out of securities to calculate a value-at-risk number for the Bank of Tennessee, which may have at least represented the state of Caldwell and Company whose detailed balance sheet data is not available. However, the lists of assets on record were incomplete and inconsistent from year-to-year. For example, in 1924 only bonds were documented whereas in 1928 only stocks were recorded. While suggestive of the poor inspection and book-keeping standards, the nature of this data did not lend itself well to a value-at-risk analysis, which requires a more complete description of asset holdings. Given the information available it is not possible to accurately quantify Caldwell and Company's actual risk, but the discussion of their business conduct, investment strategy and ultimate insolvency make a convincing case that Caldwell and Company had taken on risk that exceeded acceptable standards.

Because Lehman was a publically traded company from 1994 onwards, its audited annual reports are readily available. The website Morningstar.com, an independent investment research site, has the annual reports that Lehman Brothers Holding Company issued to shareholders readily available. To assess the volatility of Lehman's assets in the years preceding the crisis, the historical prices of certain assets are needed. In its annual reports, Lehman broke down its asset holdings into five main categories: Mortgage and Asset Backed Securities (also includes Real Estate inventory), Government and Agency Securities, Corporate Debt, Corporate Equities and Derivatives. Commercial Paper and Money Market Securities were also included, but holdings were relatively small and were therefore excluded from calculations. The St. Louis Federal Reserve's database FRED had historical pricing for certain indices that provided a good estimate of market movements in four of the five categories. 10-Year Treasury Bonds were used to

represent the Government and Agency Securities market. Bank of America Merrill Lynch U.S. High Yield Total Return Index and Bank of America Merrill Lynch U.S. Corp Total Return Index were both used to capture the high yield and investment grade subsectors of the corporate debt market. The S&P index was used to represent the corporate equities market. Finally, 5-Year Interest Rate Swaps, the primary type of derivative that Lehman owned, was used to represent the derivatives market. The data obtained for Treasuries, High Yield Bonds, Investment Grade Bonds and Interest Rate Swaps extends from July 2000 until November 2013. Unfortunately, FRED did not have pricing data available for Mortgage-Backed Securities. However, YahooFinance! had data for an index known as MBB: iShares MBS, an index that mimics the price and yield performance of Barclay's U.S. MBS index. Because the index was not created until 2007, the only pricing data available was from March 2007 until November 2013.

The problem with using only one benchmark to represent entire asset classes is that the estimates are over-simplified and only give a rough estimate of Lehman's expected Value-at-Risk. This is an issue especially with using MBB as a benchmark for the entire MBS market. It follows the movement of mostly investment grade MBS securities, a market that was significantly more stable than the subprime market in which Lehman was heavily invested. Additionally, commercial real estate made up a significant portion of Lehman's real estate holdings. However, commercial real estate is not reflected in the MBB index either. Because neither subprime securities nor commercial real estate securities were well accounted for in the available pricing data, the Value-at-Risk estimates are expected to be on the conservative side, which means that the results actually undervalue the riskiness of Lehman's balance sheet. Also, using prices until 2013 means that the 2008 market dislocation is included in the volatility measures. In 2007, it would have been near impossible to predict such a severe drop-off in asset

prices. Historical pricing data certainly would not have captured it. Therefore, estimates of risk based on post-2008 data are likely larger than they would have been using only data from 2007 and before. While it would have been nearly impossible to have anticipated such a severe drop in asset prices, good risk management should ensure that the company is in a position to withstand greater volatility in asset prices than what is suggested by historical prices. Despite imperfections in the data, the results should still adequately show that Lehman had allowed for an unjustifiable amount of risk to accumulate on its balance sheet. It also shows that the riskiness of the firm should have been apparent if sufficient internal controls had been in place.

### *Data Transformation*

The formula below was used to calculate gross leverage ratio for both Lehman Brothers and Caldwell and Company:

$$\text{Capital to Asset ratio} = \text{Shareholder's Equity} / \text{Total Assets}$$

The results are summarized in the following tables along with the results for comparable companies to provide a point of reference:

Year	Caldwell and Company	C&C Y-o-Y % Change	Lehman Brothers	LBH Y-o-Y % Change
t-12	-	-	0.032	-
t-11	0.047	-	0.030	-6.3%
t-10	0.013	-72.3%	0.030	0.0%
t-9	0.011	-15.4%	0.035	16.7%
t-8	0.011	0.0%	0.033	-5.7%
t-7	0.009	-18.2%	0.035	6.1%
t-6	0.006	-33.3%	0.064	82.9%
t-5	0.006	0.0%	0.034	-46.9%
t-4	0.005	-16.7%	0.042	23.5%
t-3	0.004	-20.0%	0.042	0.0%
t-2	0.003	-25.0%	0.041	-2.4%
t-1	0.003	0.0%	0.038	-7.3%
Bankruptcy, year t	0.003	0.0%	0.033	-13.2%

<sup>(a)</sup>Data from McFerrin's *Caldwell and Company: A Southern Financial Empire* and Lehman Brothers annual report

**Lehman Brothers and Comparable Companies Capital/Asset Ratio<sup>(a)</sup>**

Year	Lehman Brothers	Bear Stearns	Morgan Stanley
1995	0.032	0.034	-
1996	0.030	0.031	0.049
1997	0.030	0.030	0.046
1998	0.035	0.030	0.044
1999	0.033	0.035	0.046
2000	0.035	0.034	0.046
2001	0.064	0.030	0.043
2002	0.034	0.035	0.041
2003	0.042	0.036	0.041
2004	0.042	0.036	0.038
2005	0.041	0.038	0.032
2006	0.038	0.035	0.032
2007	0.033	0.030	0.030

<sup>(a)</sup>Data from Lehman Brothers, Bear Stearns and Morgan Stanley annual reports

The capital/asset ratio is extremely informative. This metric provides a measure of a bank's cushion against losses. In other words, losses accrued on assets are absorbed by the bank's capital stock. In both cases, the amount of capital held was extremely small when compared with gross asset holdings. Banks have incentives to keep capital stock low for a couple of reasons. First, capital raises dilute the value of existing equity. In addition, investors often interpret capital raising efforts as a sign of financial weakness (Dudley). Finally, for banks trying to maximize return, debt is preferred because it magnifies investment gains. Of course, the downside of using debt is that it magnifies investment losses as well while burdening company finances with interest expense and credit risk. Because it reveals the debt to equity distribution of a company's liabilities, the capital/asset ratio is one of the most informative measures of risk.

Calculating Lehman's Value-at-Risk is a considerably more complex procedure. The first step is to choose the parameters, which in this model are the confidence interval and holding period. Following convention, I specified a 95% confidence level. Assuming distributions of asset prices are standard normal, a 95% confidence level translates into about 1.6455 for a



cumulative standard normal distribution. This assumption is important to note because financial asset returns do not necessarily have normal distributions especially in the event of market dislocation. To provide evidence of non-normality, financial economist Eugene Fama analyzed the distributions of asset prices by constructing a frequency distribution. He found that the distributions of all 30 stocks that he analyzed had a higher peak and longer tails than what was predicted by the normal distribution assumption (Fama 48). His findings suggest that large deviations from the mean occur with greater frequency than a normal distribution would suggest. To quantify these implications, the frequency of seeing a price that is five standard deviations away from the mean is 0.0006 assuming normality but Fama's research estimated that frequency to be 0.12, which is 2000 times larger (Fama 49). From this Fama concluded that "[...] Under the Gaussian hypothesis for any given stock an observation more than five standard deviations from the mean should be observed about once every 7000 years. In fact such observations seem to occur about once every three to four years" (Fama 50). More generally, Fama's findings suggest that movements in stock prices are far more risky than the normal distribution implies, making the normality assumption a potentially misleading one upon which to base a risk evaluation model. Nevertheless, convention is to assume normal distribution of prices and returns, so I assumed normality for my Value-at-Risk analysis.

Because the pricing data for all asset classes was collected on a monthly basis, I used one month for the holding period. The next step was to combine all of the historical pricing data into a single spreadsheet. Then, I took the natural log of the monthly price changes to transform the data into percent change. From there, I constructed a correlation matrix relating the five asset classes. The matrix is reproduced below:

	<b>MBS</b>	<b>Derivatives</b>	<b>Equities</b>	<b>IG Debt</b>	<b>HY Debt</b>	<b>Treasury Bonds</b>
<b>MBS</b>	100.0%	-58.2%	-16.7%	37.6%	-4.7%	-55.2%
<b>Derivatives</b>	-58.2%	100.0%	29.8%	-50.4%	13.9%	93.2%
<b>Equities</b>	-16.7%	29.8%	100.0%	34.2%	71.8%	32.1%
<b>IG Debt</b>	37.6%	-50.4%	34.2%	100.0%	63.8%	-49.9%
<b>HY Debt</b>	-4.7%	13.9%	71.8%	63.8%	100.0%	19.1%
<b>Treasury Bonds</b>	-55.2%	93.2%	32.1%	-49.9%	19.1%	100.0%

Looking carefully at this chart reveals the unexpectedly high correlation between the different asset classes on Lehman's balance sheet. These high correlations suggest that Lehman's balance sheet, even when taking into consideration different types of assets, is not well-diversified, which only adds to overall riskiness. Finding the standard deviation of each asset class using historical pricing data produced an estimate of asset volatilities. Lehman's balance sheet data quantified the dollar value of the firm's holdings in each asset category. This information indicates Lehman's relative investment in each financial product. The following expression evaluates individual asset (as opposed to portfolio) Value-at-Risk's for each of the five asset types:

$$\text{Asset Value-at-Risk} = \text{standard deviation} \times \text{position} \times 1.6455$$

After calculating individual asset Value-at-Risk for all five asset classes, the asset Value-at-Risk vector must be transposed for the ensuing matrix multiplication. To find portfolio Value-at-Risk at the 95% confidence level over a one month period, the data must undergo the following calculations:

**Step 1:** multiply the correlation matrix by the transposed asset Value-at-Risk vector. This

is an array function, so the result will be another vector with dimensions 1x5.

**Step 2:** multiply the vector calculated in step 1 by the asset Value-at-Risk vector

**Step 3:** Take the square root of the number produced in step 2

The final number means that there is a 5% chance that Lehman will sustain a loss of that amount over the course of one month. Because I used yearly balance sheet data, I multiplied the portfolio

Value-at-Risk's by 12 to obtain Lehman's annual portfolio Value-at-Risk metric. Transforming the yearly Value-at-Risk into a percentage of total assets makes the information readily comparable to the capital/asset ratio. The findings are reproduced below:

A Comparison of Lehman Brothers' Yearly VaR (as a % of total assets) to its Capital (as a % of total assets):

Year	2007	2006	2005	2004	2003	2002	2001	2000
Yearly VaR (in Billions)	\$64.1	\$48.1	\$36.4	\$29.2	\$24.7	\$21.9	\$25.2	\$23.9
% of Total Assets	9.28%	9.55%	8.86%	8.18%	7.90%	8.40%	10.16%	10.64%
Capital as a % of Assets	3.25%	3.81%	4.10%	4.18%	4.22%	3.43%	3.41%	3.46%

To interpret this chart, examine the results for 2007. Lehman's annual Value-at-Risk as a percentage of total assets is around 9.28%, which means that there is a 5% chance that Lehman's total asset value will decline by 9.28% over the course of 2007. However, Lehman has only enough capital to withstand a 3.25% decline, far below the estimated Value-at-Risk. To be adequately capitalized, Lehman should have enough capital on its books to absorb a worse-case scenario loss. In general for a firm to be adequately capitalized:

$$\text{Value-at-Risk (as a percentage of total assets)} < \text{Capital to Asset Ratio}$$

Using the results above, it can be concluded that Lehman was undercapitalized from 2000 until 2007. Thus, evaluating Value-at-Risk as a percentage of total assets alongside capital as a percentage of assets serves as a type of internal stress test. The comparison of the two metrics highlights whether the firm could survive if a worst-case scenario loss were to occur. While this stress test may help improve internal risk management, it is not sufficient. Regulatory agencies must also conduct supervisory stress tests and impose certain restrictions if real progress is to be made because as Lehman and Caldwell demonstrate self-regulation is unlikely given investment banking industry paradigms.

*Conclusion*

Michael A. Seamans, a financial industry analyst for the Dallas Federal Reserve, concisely summarized the role of the banking industry: “Banks are in the business of risk [...] (Seamans 1). In order to generate return, investment banks must be willing to take on risk. The trade-off between risk and return is one of the fundamental laws governing the actions and behavior of banks. However, the pursuit of return can and has historically displaced all other financial functions to become the operative goal of financial institutions. The exclusive focus on return encourages unchecked risky behavior that history shows can result in large-scale financial meltdowns. To avoid such behavior in the future, investment institutions must be subject to greater supervision because as even Goldman Sachs CEO Lloyd Blankfein admits: “Self-regulation has its limits” (Tibman 109). Self-regulation entrusts investment banks with far too much freedom, incorrectly assuming that internal incentives are sufficient to make risk management a priority. In reality, the cutthroat competitiveness of the industry, the strictly hierarchical structure of investment banks and the nature of bank compensation plans are designed such that profit takes precedence over risk (Wall 1). In fact, incentives of banks are aligned in such a way that there is actually a disincentive to manage risk as it often impedes a firm’s ability to maximize return. The mismanagement of both Caldwell and Company and Lehman Brothers exemplifies the potential consequences of misaligned incentives that typify most large Wall Street banks. Because extraordinary revenues translated into extravagant bonuses for CEOs like Fuld and Caldwell, they had no reason to promote risk management, which would dampen profit and subsequently their own payment packages. As a result, Caldwell and Fuld both approved business strategies that led to the severe undercapitalization of company

balance sheets as shown by the Value-at-Risk analysis. Similarly, they rewarded large-scale investments in highly risky assets like those often associated with emerging markets. In doing so, they made their respective firms very vulnerable to slight movements in asset prices to say nothing of complete market dislocation. In the end, Caldwell and Fuld learned the severe consequences of greed and hubris. They both gambled their firms and lost. Their negative contributions to what are likely going to be the two most important economic events of this century will forever define their careers.

Recognizing the flaws with self-regulation policies, the Federal Reserve has spent the years after the 2008 financial collapse developing regulation, primarily stress-tests, to evaluate the vulnerability of the largest financial institutions to severe adverse shocks. Economists have proposed a number of methodologies for conducting stress tests and continue to refine existing ones. Some tests focus on specific types of risk such as credit risk, liquidity risk or interest risk whereas others are more generic (Blaschke 4). The Federal Reserve will not release the specifications of its stress test, but, in general, it proposes a scenario and then analyzes bank balance sheet data to determine whether institutions have sufficient capital to function properly after the hypothetical shock has hit the markets (Bernanke). Since 2009, the Federal Reserve has been working to revise its methodology, developing independent data banks rather than relying on bank estimates as a starting point. Because of recent successes with regulatory stress tests, the Dodd-Frank Wall Street Reform Act mandated stress tests become a permanent form of regulation for the banking industry (Bernanke). As a result, supervisory stress tests are now an annual process for the 19 largest banks as well as 11 other institutions deemed critical to the financial system (Bernanke). The Federal Reserve stress test encompasses more than 40 different models used to identify risk within portfolios. Due to the complexity of the tests and the value of

the results, the Fed has created a model validation group to improve upon the models and a model validation council to provide independent advice on ways that banks can reduce risk. Other changes post-2009 include the creation of a Comprehensive Capital Assessment Review (CCAR) program that requires banks with over \$50 billion in assets to perform internal stress tests and submit a report of their capital planning process for approval (Dudley). The purpose of CCAR is to determine the risk appetite of a firm, controls within the firm put in place to discourage excessive risk-taking and the governing ability of executives (Dudley). The efforts of the Fed and congress to improve upon stress tests demonstrates the important role that this regulatory tool will likely play in preventing the collapse of huge financial institutions.

Going forward, regulatory agencies must continue to find ways to effectively monitor balance sheet growth without preventing investment banks from performing their intended function, which if performed correctly is vital to economic efficiency. Within the individual companies, incentives must be re-aligned so that CEOs will no longer be rewarded with multi-million dollar bonuses for promoting a “greed is good” culture within their companies. Compensation should reflect long-term goals rather than focusing on short-term revenue generation. In addition to restructuring compensation packages, the dictatorial structure of many of these firms must be altered to reestablish a checks and balance system within the firm and to ensure that the risk management team can perform their jobs without fear of being fired. Though these regulatory changes are far from exhaustive, they will likely help prevent against another widespread banking crisis that descends into an economic crisis as was the case during both the Great Depression and Great Recession.

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