THREE ESSAYS ON FINANCIAL MARKETS

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Lay Abstract

This thesis studies the effects of important events on the financial markets. The first two essays study the market impact of a very successful financial innovation – the SPDR Gold Trust exchange-traded fund (GLD). I find that the introduction of GLD has significantly negative effects on both the trading characteristics and the pricing of gold company stocks. The findings contribute to the literature by showing that existing securities can be negatively affected when a new security enters the market. The third essay uses unionization as an identification tool to study the conflicts between workers and creditors of firms. The results show that unionization reduces bond value significantly due to the fact that firms' costs during the bankruptcy process are increased substantially by labor unions. The essay furthers the understanding of the impact of worker organization on other stakeholders.

Abstract

This thesis includes three essays that examine the effects of important events on the financial markets.

The first two essays study the market impact of a very successful financial innovation – the SPDR Gold Trust exchange-traded fund (GLD). I find that after the introduction of GLD, the liquidity of gold company stocks declined, and their adverse-selection risk increased. Over the two-month period after GLD's introduction, the stocks' relative effective bid-ask spreads increased by over 15%, while their adverse-selection cost, as measured by the price impact of trades, went up by more than 30%. Gold stocks also experienced significant negative abnormal returns (-12% on average) in the month after GLD started trading. My findings suggest that GLD attracted traders, especially uninformed traders, away from gold company stocks. My results show that existing securities can be seriously adversely affected when a new security enters the market.

The third essay studies the effect of unionization on unsecured corporate creditors by testing the price reaction of publicly-traded bonds to union certification elections. I and my co-authors gather data on union elections covering several decades and employ a regression discontinuity design to identify the effect of worker unionization on bondholders' wealth. We find that closely-won union elections lead to a 200 (500) basis points greater decline in bond cumulative abnormal returns than closely-lost elections during the 3-month (12-month) post-election window. However, unionization does not lead to poorer firm performance or higher default risk. Critically, the results show that

unionization is associated with longer proceedings in bankruptcy court, with more bankruptcy emergences and subsequent refilings, and with higher fees and expenses paid to lawyers and financial experts in court. All of the costs diminish corporate asset values, aggravating bondholders' losses.

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Chapter 1 : Introduction

This thesis includes three essays that examine the effects of important events on the financial markets. The first two essays investigate how the introduction of new financial instruments affects existing, related securities. The third essay studies how unionization affects the cost of borrowing and the welfare of creditors. Each of these three essays is self-contained and presented in chapters 2 to 4. In this chapter, I highlight their motivations, primary results, and main contributions to literature.

The first essay studies the market impact of a very successful case of commodity securitization. The security is the SPDR Gold Trust exchange-traded fund (Tic: GLD), which is the first commodity-backed exchange-traded fund (ETF) in the U.S. market. Introduced to the market in November 2004, GLD holds physical gold as its underlying assets, and, as a result, its returns (before expenses) track the returns on gold almost perfectly. It has since become very popular with investors. At one time, it was the second largest ETF in the world in terms of assets under management. The introduction of GLD represented a landmark decision of the Securities and Exchange Commission (SEC), because prior to its existence, there had not been any commodity-backed ETF in the U.S. market. GLD provides investors with an easy and convenient way to invest in gold. It also enables some investors such as pension funds and mutual funds, who are typically prohibited by their charters from holding physical commodities, to have a direct exposure to gold. More importantly, GLD has paved the way for the introductions of other commodity-backed ETFs.

Theoretically, the introduction of a new security can affect existing securities' trading in several ways (e.g., improving risk sharing, creating arbitrage opportunities with existing securities, causing investors to rebalance their portfolios, and changing existing securities' investor clienteles). The main objective of my first essay is to examine the effect of GLD's introduction on the trading characteristics of gold company stocks. I find that the demand for gold company stocks declined after GLD's inception. I show that various measures of the stocks' liquidity deteriorated. For example, the relative effective bid-ask spreads of gold company stocks rose by more than 15% over the two-month period following GLD's introduction. More importantly, the adverse selection cost of trading gold company stocks and the proportion of their outstanding shares held by institutional investors increased significantly. These results are robust against changes that occurred in the market and/or the mining industry in the sample period. Altogether, the results indicate that investors, especially retail investors, migrated from gold company stocks to GLD after its introduction. The intuition for the results is that because GLD is a less information-sensitive security than gold company stocks, it appeals to retail/uninformed investors who would typically lose to informed traders if they trade gold company stocks.

This essay adds to the literature on financial innovations. The current literature mainly focuses on the market impact of futures contracts and options. It is much less common to find evidence based on other types of securities. This is because futures contracts and options are very successful financial innovations, and thus their presence can have noticeable impacts on related securities. As GLD is also a very successful innovation, its introduction provides me with a unique opportunity to study how new financial instruments affect the trading of existing related securities in a different context. In addition, the essay contributes to an emerging body of literature on commodity securitization by showing that commodity securitization can have negative effects on commodity companies by attracting investors away from them, changing the composition of their investor clienteles, and draining their liquidity.

The second essay furthers the first essay by studying how the introduction of GLD affected the pricing of gold company stocks. In a market where assets have perfect substitutions, their prices are not affected by changes in their demand; otherwise, there would be an arbitrage opportunity. In reality, however, perfect substitutions do not exist. Hence, demand curves for stocks can be downward-sloping, and so their prices can change if their demand changes. In addition, current literature shows that asset prices also depend on their liquidity, as investors require higher returns to compensate for higher transaction costs. As I have shown in the first essay that the demand and liquidity of gold company stocks declined after GLD's introduction, I now want to investigate whether the prices of gold company stocks were also affected.

To do so, I adopt an event-parameter approach to study how GLD's introduction affected the pricing of gold company stocks. I find that gold company stocks significantly underperformed the benchmark after GLD started trading. On average, gold stocks experienced a negative abnormal return of –1.90% on GLD's introduction day, and a cumulative abnormal return of approximately –12% during the first month. Next, I examine the relative importance of declining demand and lower liquidity in explaining the observed abnormal returns. The results show that while the abnormal returns were associated with both causes, the effect of the negative demand shock was more significant than the effect of the decline in liquidity.

This essay contributes to the current literature in two major ways. First, it adds to the literature on commodity securitization. Few papers study the effect of commodity securitization on the pricing and return dynamics of existing, related securities. This essay fills this gap in the literature and shows that commodity securitization can create competing securities to existing securities and have a negative impact on their prices. Secondly, my results provide supporting evidence to the argument that demand curves for stocks slope down and thus changes in demand can affect asset prices. Current literature that studies how changes in demand may affect asset prices mainly focuses on stocks' inclusions into, or removals from, major stock indices. These studies document that stocks that were newly included into (removed from) a major stock index earned significant positive (negative) abnormal returns during the adjustment periods. My results offer evidence on the demand effect from a new and unique context.

My third essay is co-authored with Murillo Campello, Janet Gao, and Jiaping Qiu. The essay studies how the actions of workers, who themselves are important stakeholders of their companies, affect the welfare of other stakeholders. This is an area of research that has not yet been extensively investigated. Specifically, this essay examines how unionization affects the pricing of bonds and the welfare of bondholders. On the one hand, both workers and bondholders are fixed-claim holders. They are both risk averse and dislike risky projects. As a result, some actions taken by unions to protect workers' interests may also benefit the bondholders and decrease the default probabilities. On the other hand, strong unions can have negative impacts on firms' profitability and operating flexibility. They may also resist assets sales and employee layoff and go against efficient liquidation at the cost of bondholders in insolvent states. Due to the conflicting effects, how labor unions affect the cost of borrowing and the welfare of bondholders is an empirical question.

In the U.S., unions need a legal status to gain bargaining power. They can obtain the legal status if they gain a majority of votes (i.e., greater than 50%) in a secret-ballot union election among workers. We manually create a data set that merges information on union elections and bond returns. Unionization can be endogenous to firm performance. However, in a small local area around the 50% vote share for union cutoff point, gaining a union legal status is like a random and exogenous event. Due to the special nature of the data, we are able to adopt a regression discontinuity design, which is a quasi-experimental test, to study how unionization affects bond value and draw causal conclusions. Specifically, we compare bonds' abnormal returns between elections in which workers were marginally in favor of establishing a union and elections in which workers were marginally against. The results show that bond prices of close winners reacted much more negatively than those of close losers, which indicates that unionization caused a significant decline in bond value. We further show that the negative bond market reaction is due to unions' negative impacts on firms' bankruptcy costs rather than their impacts on firms' default probability. More specifically, we find that unions do not have significant impacts on firm performance or default risks. However, unions are associated with longer proceedings in bankruptcy court, more bankruptcy emergences and subsequent refilings, and higher bankruptcy fees and expenses, all of which aggravate bondholders' losses.

This essay contributes to the literature in several ways. First, current literature mainly studies the effects of unionization on the cost of borrowing in solvent states. They find that labor unions decrease the default risks, and thus are beneficial to creditors. To our knowledge, this essay is the first paper that studies how labor unions affect creditors in insolvent states and investigates the dynamic relationship between labor unions and creditors systematically. More broadly, this essay adds to a growing line of research on how human capital and organized labor influence firm financing. It contributes to this literature by showing that unions can be detrimental to unsecured creditors, a result that further helps to explain the negative association between debt ratios and unionization. In all, this essay furthers our understanding of the impact of worker organization on corporate investors, an important facet of firm-labor relations.

Chapter 2 : The Securitization of Gold and Its Potential Impact on Gold Stocks' Trading

2.1 Introduction

In this chapter, I study the market impact of a very successful financial innovation. The innovation is the SPDR Gold Trust exchange-traded fund (Tic: GLD), which is the first bullion-backed exchange-traded fund introduced in the U.S. market. GLD was introduced in November 2004 and has since grown to become one of the largest exchange-traded funds (ETFs) in terms of assets under management ($72 billion as of the end of December 2012).[1] The fund holds physical gold and so its net asset values are almost perfectly correlated with the movements of gold price (except for fees and expenses). As an ETF, GLD can be traded during regular trading hours. In effect, GLD is a securitization of gold, and provides traders with a convenient and cost-effective way to invest in gold.

The main objective of this chapter is to examine the effect of GLD's introduction on the trading characteristics of gold companies stocks. The existing literature offers several reasons why the introduction of a new security can affect existing securities, especially closely related ones. These include improved risk sharing (e.g., Detemple and Selden, 1991; Calvet et al., 2004), rebalancing of investor portfolios (e.g., Braun and Larrain, 2009), changes in the composition of investor clientele (e.g., Subrahmanyam, 1991; Gorton and Pennacchi, 1993), and greater opportunities for arbitrage trades (e.g., Dow, 1998; Rahi and Zigrand, 2009). The introduction of GLD provides me with a good

[1] As a comparison, the largest ETF in the US market (i.e., the SPDR S&P 500) had assets of $123 billion at the end of 2012.

opportunity to investigate empirically the impact of a new security. An opportunity like this is rare in the study of financial innovation because most new securities did not become as hugely popular as GLD, and thus their impacts on the markets were typically negligible.

Using a sample of gold company stocks traded in the U.S. market when GLD was introduced, I find that various measures of stocks' liquidity deteriorated after GLD started trading. For example, on average, the stocks' relative effective bid-ask spreads increased by over 15% in the two-month period following GLD's introduction. During the same period, their adverse-selection cost, as measured by the price impact of trades, went up by more than 30%. Their trading volume (both in terms of shares and dollars) also significantly declined. In addition, the percentage of outstanding shares of gold company stocks held by institutional investors significantly increased. These findings support the adverse-selection argument, which predicts that uninformed traders will migrate away from information-sensitive securities once a less information-sensitive alternative is introduced (Subrahmanyam, 1991). GLD is less information-sensitive than gold company stocks because the performance of GLD depends only on the movements of gold prices while the performance of gold stocks also depends on firm-specific factors such as management ability and cost structures. The migration caused the liquidity of gold stocks to deteriorate, and their adverse-selection risk to increase.[2]

[2] A migration of traders from gold company stocks to GLD has also been mentioned in the media. See, for example, "Heard on the Street: Gold Miners Lost Midas Touch" in the February 24, 2012 edition of the *Wall Street Journal*.

My results suggest that the introduction of a new security can have a serious adverse impact on the trading characteristics of existing, related securities. The results are related primarily to studies that investigate the market impact of financial innovations. Typically, these studies concentrate on futures contracts and options and their impacts on the underlying securities (See Mayhew, 2000, for a review). This concentration is due mainly to the fact that futures contracts and options are very successful innovations and thus their presence can have a noticeable influence on related securities. It is much less common in the literature to find evidence based on other types of securities. There are, however, some exceptions. For example, a few studies report that the introduction of index ETFs increased the liquidity of constituent stocks (Hegde and McDermott, 2004; Richie and Madura, 2007; Madura and Ngo, 2008). My results are in contrast to these findings. I believe that this is due to the fact that although index ETFs can attract some traders away from their constituent stocks, the ETFs themselves have to trade the stocks, and also create arbitrage opportunities with the stocks. The net effect is that the stocks' liquidity is improved. On the other hand, GLD competes with gold company stocks, and its arbitrage linkage with gold stocks is not as strong. Accordingly, my results show that the experience in one market does not necessarily carry over to another market.

More importantly, this essay contributes to an emerging body of literature on commodity securitization. It shows that commodity securitization can create competing securities and have negative effects on existing related securities. More specifically, this essay documents that commodity securitization may attract the investors of commodity companies away and change those companies' composition of investor clientele.

The essay is organized as follows. In the next section, I describe the background of GLD. In Section 2.3, I discuss theoretical predictions on the effects of GLD on the trading characteristics of gold stocks. In Section 2.4, I describe the data I use in this essay. In Section 2.5, I present the empirical findings. Finally, Section 2.6 concludes.

2.2 Background of GLD and Other Bullion-Backed Securities

The SPDR Gold Trust was formed in November 2004 as an investment trust. The trust is sponsored by World Gold Trust Services, a wholly owned subsidiary of the World Gold Council, whose members are leading gold mining companies such as Barrick Gold and Newmont Mining Corp. The trust's objective is to promote investment in gold by providing investors with a secure and cost-effective access to the gold market. To do so, the trust holds gold bars and issues shares which represent ownership of the trust. The shares started trading on the New York Stock Exchange (NYSE) on November 18, 2004 under the tic symbol GLD.

At its inception, each share of GLD corresponded to 0.10 ounces of gold. Over time, the trust has gradually sold gold to pay the trust's expenses such as operating costs, custodian fees (i.e., storage costs) and marketing expenses. Therefore, the number of ounces per share has gradually declined over time (to 0.09684 ounces per share as of the end of 2012). So far throughout its life, the trust's expense ratio has been kept at 0.40% per year of the trust's net asset value (NAV). For most investors (especially retail ones), this rate of expenses makes investing in gold through GLD less costly than buying/selling, storing and insuring physical gold.

Similar to other exchange-traded funds, shares of GLD can be created and redeemed directly with the trust in large lots (multiples of 100,000 shares) by authorized participants, typically designated brokers and market makers. Creation and redemption are done in kind; i.e., by exchanging shares with a specified amount of gold. The process helps to provide liquidity to GLD trading as market makers can, if needed, create or redeem shares in order to execute investor orders. The creation/redemption provision also establishes an arbitrage relationship between market price and NAV, helping to keep them in line with each other. As with conventional ETFs, GLD can be bought on margin or sold short.

When GLD was introduced, there were a few bullion-backed, exchange-listed securities in existence outside the U.S. market but accessible to U.S. investors, the prime example of which was the Central Gold Trust (listed on the Toronto Stock Exchange). However, at the time, these securities as a group did not attract significant investment attention. According to a survey by Gold Field Mineral Services, an independent precious metals consulting firm, the combined gold demand from these securities in the whole of 2003 (the year before GLD was introduced) was only approximately 39 tonnes or 1.25 million ounces (worth approximately $520 million based on gold price at the end of 2003).[3] By comparison, after only a week in its existence, GLD was holding over 3 million ounces of gold (worth approximately $1.46 billion). The holdings grew to over 7 million ounces after a year (worth approximately $3.46 billion). This suggests that the introduction of GLD created significant interest and awareness among investors.

[3] For a summary of gold investment demand in various years, see the prospectus of SPDR Gold Trust dated May 27, 2010.

Over the years, the investment in GLD continued to grow. This coincided with a substantial rise in gold price. From the inception of GLD to the end of 2012, gold price increased by approximately 275% – from around $440/ounce to $1,650/ounce. At the end of 2012, GLD held over $72 billion worth of gold (over 43 million ounces), making it the second largest ETF in the world. Its success has spawned several other bullion-backed ETFs, both in the U.S. market (with currently four ETFs) and abroad (e.g., Canada, the UK, Switzerland and South Africa).[4]

Because GLD holds physical gold and has low expenses, its tracking errors are very low. From its inception to the end of 2012, the correlation between the percentage changes in its NAVs and the percentage changes in gold prices is 0.9885.[5] In addition, because of the creation/redemption provision, GLD is priced efficiently, as evidenced by the fact that its premiums/discounts (i.e., deviations of market prices from its NAVs) have been very low. From its inception to the end of 2012, the average price deviation is only 0.016% of

[4] GLD's success has also led to the introduction of other physically backed ETFs such as silver, platinum and palladium ETFs. However, except for silver ETFs, these other ETFs have not been able to attract much interest from investors.

[5] I calculated the correlation based on the percentage changes in the NAVs and the percentage changes in the London PM fix gold prices. The London PM fix gold prices are a widely followed benchmark, and are the prices that the trust uses in determining the NAVs.

the fund's end-of-day *indicative* NAVs.[6] As a result, GLD can be thought of as an extremely close substitution for physical gold.[7]

2.3 Theoretical Predictions

The existing literature provides several reasons why the introduction of a new security can affect the trading characteristics of existing, related securities. The predictions vary depending on the setup and the assumptions of the models. Here, I mention three arguments that are relevant to the context of GLD and gold company stocks.

A. The Adverse-Selection Argument

The adverse-selection argument is due primarily to the work of Subrahmanyam (1991) and Gorton and Pennacchi (1993).[8] Both of these studies attempt to explain the benefits of "composite" or basket securities such as index-linked funds and index-linked futures contracts. In their models, there are two types of traders – informed traders (who possess specific information about individual stocks) and liquidity traders (who trade for reasons not directly related to the stocks' payoffs). They then show that if a basket security is introduced, liquidity traders who wish to hold portfolios of stocks will migrate from

[6] I calculated price deviations by comparing GLD's closing prices to its closing indicative NAVs. An indicative NAV (or indicative value) is a measure of a fund's NAV at a given point in time during a trading day. During trading hours, U.S. fund companies are required to publish the indicative values of their ETFs every 15 seconds. I used closing indicative NAVs in the calculation because, as mentioned earlier, the official NAV that the trust reports daily is based on London PM fix gold price, which comes from earlier in the day and so should not be compared with GLD's closing prices.

[7] As a comparison, over the same period, the correlation between the percentage changes in the NAVs of the SPDR S&P 500 ETF and the percentage changes in the S&P 500 is 0.9996, while the average price deviation is -0.008%.

[8] A similar argument is made in John, Koticha and Subrahmanyam (1993). Other studies that discuss this argument informally include Gammill and Perold (1989) and Harris (1990).

individual stocks to the basket security. This is because the expected losses by liquidity traders to informed traders are lower in the basket security than in individual stocks. The reason for this is that informed traders' orders tend to offset each other in the basket security, and so firm-specific information tends to be "diversified" in it. This diversification reduces the adverse-selection costs faced by liquidity traders when they trade in the basket. Accordingly, liquidity traders have an incentive to concentrate their trades in the basket security when it is introduced.

The implication of both studies is that once an alternative security which is less information-sensitive is introduced, there will be a migration of liquidity traders to this new security. In my context, GLD is a less information-sensitive security than individual gold stocks. This is because, as mentioned earlier, the performance of GLD depends only on gold price movements, while the performance of gold company stocks depends not only on gold price movements but also on firm-specific factors such as management ability, cost structures, and hedging policies. As a result, liquidity traders have a higher chance of losing to informed traders if they trade individual gold stocks than if they trade GLD. It then follows that liquidity traders who wanted direct exposure to gold price movements would have a strong incentive to migrate to GLD when it was introduced.[9]

[9] Jin and Jorion (2006, 2007) argue that many investors in certain commodity stocks such as gold and oil stocks invest in the stocks to gain exposure to gold and oil prices respectively. As a result, hedging of price risk done by these companies should not be valued by investors. Using data on gold companies' hedging activities from 1991 to 2000, Jin and Jorion (2007) report that hedging did not increase firm value, and might even have decreased it. Their findings are consistent with a widely-held view at the time among practitioners that investors of gold stocks actually wanted a pure play on gold price. In fact, there was anecdotal evidence that when some gold companies announced that they would pare down their hedging (i.e., to become more pure-play), their stock prices reacted positively (See, for example, "Gold Soars as Placer Dome Stops Hedging" in the February 5, 2000 edition of the *Financial Post* newspaper).

Accordingly, the adverse-selection argument predicts that gold company stocks should become less liquid after the introduction of GLD. With fewer liquidity traders remaining, the stocks' adverse-selection costs should increase, and the composition of traders in them (i.e., the mix between informed and liquidity traders) should also change, with informed traders representing a higher proportion than before.

B. The Arbitrage Argument

The introduction of a new security can have an effect on the trading of existing, related securities if it encourages arbitrage activities between them. Dow (1998) and Rahi and Zigrand (2009) argue that profiting from arbitrage trades is one of the main motivations behind the creation of new securities.[10] In their models, arbitrageurs (e.g., investment banks and hedge funds) create new securities to open new markets. They then exploit price discrepancies between the new markets and the markets for existing, related securities. Here, the term "arbitrage" is used in a broader sense to include a speculative transaction with a high expected payoff and a risk that can be partially hedged (i.e., *risk* arbitrage). For example, an index ETF can be introduced so that the innovator can benefit from arbitrage trades between it and the stock portfolio, which may consist of a much smaller number of stocks than the whole index (and thus have a tracking-error risk).

[10] The traditional view of financial innovation is that innovators issue new securities to improve risk sharing by making the market more complete, reducing market imperfection costs, or circumventing regulatory constraints (e,g., Van Horne, 1985; Miller, 1991). More recent studies, however, examine other possible motives such as to create arbitrage opportunities or to capitalize on investors' misunderstanding of the risks of the new securities (e.g., Henderson and Pearson, 2011; Gennaioli et al., 2012) .

In my context, the existence of GLD makes it easier and/or less costly for traders to implement long-short trades, which are one of the most common risk-arbitrage trading strategies that hedge funds and many portfolio managers employ (Fung and Hsieh, 2011).[11] Traders who believe that certain gold company stocks are undervalued (overvalued) relative to the price of gold can take long (short) positions in those stocks and a short (long) position in gold. This trade enables the traders to gain exposure to company-specific factors while removing gold price risk (i.e., to make purer bets on company-specific information). Prior to the introduction of GLD, the position in gold would have to be established through gold bullions or gold futures contracts. Both approaches have their shortcomings. Gold bullions require storage, insurance and possible assay testing, all of which add costs to the position. Gold bullions also sell at a premium to the gold spot price (due to manufacturing costs and dealer overheads). While the premium is typically small for large transactions, it can vary depending on market conditions, thus creating another dimension of risk. For gold futures, they need to be rolled over regularly, and, more importantly, have basis risk. The existence of GLD provides traders with a cost-effective and more precise tool to use when implementing their long-short trades.[12]

As Simsek (2013) argues, a new security can be used by traders to hedge their bets on existing securities, which, in turn, enables them to take greater positions on their bets. Simsek terms this effect the "hedge-more/bet-more" effect. The increase in speculative

[11] Fung and Hsieh (2011) report that roughly 40% of hedge funds in the Lipper-Tass database are classified as having long-short strategies as their primary investment style (as of December 2008).
[12] The use of long-short trading strategies involving gold and gold company stocks has regularly been reported and/or advocated in the press and practitioner publications. For a recent example, see "CIBC Develops Quantitative Long/Short Gold Model" in the August 14, 2013 edition of the *National Post* newspaper.

activities should add liquidity to gold company stocks. In addition, greater competition among these (informed) traders can help to reduce market makers' expected losses, and so the adverse-selection costs of gold company stocks can become lower.[13]

C. The Market-Making Argument

Silber (1985) argues that if market makers can use a new security to partially hedge their inventory risk (in the existing securities), they will be able to quote narrower bid-ask spreads for the existing securities. He cites an example of block-trading desks routinely using index futures contracts to hedge their exposure to specific stocks. In my context, the existence of GLD provides market makers for gold company stocks with an alternative hedging tool to gold futures contracts. As mentioned above, as a hedging tool, GLD is more precise than gold futures because of the presence of basis risk in futures contracts. This is especially true for short-term hedging, which is what market makers typically need.[14] Therefore, applied to my context, Silber's argument implies that liquidity of gold company stocks should improve after GLD was introduced.

D. Summary of Arguments

[13] The impact of an increase in the number of informed traders on the stock's liquidity and adverse-selection cost is complex and depends on the model settings. For example, Admati and Pfleiderer (1988) show that when the trading demand of liquidity traders is exogenous and all informed traders observe the same signal, liquidity will increase in the number of informed traders. See Spiegel and Subrahmanyam (1992) for a detailed discussion.

[14] Figlewski (1985) examines the use of index futures contracts to hedge the systematic risk of individual stocks and stock portfolios. He shows that the price differences between the futures contracts and the underlying index can lead to substantial basis risk if the contracts are not held until maturity. Note that this basis risk is due to a maturity mismatch (between the maturity of the contracts and the hedge horizon).

To summarize, studies from different strands of the literature offer different and conflicting predictions regarding the effects of GLD on the trading of gold company stocks. Under the adverse-selection argument, the liquidity of gold company stocks would decline and their adverse-selection risk would increase after GLD's introduction. The opposite is true under the arbitrage and the market-making arguments. It is possible, in fact likely, that more than one of these effects occur at the same time. Therefore, the issue is an empirical question, which I will address in the following section.

Empirical studies on the effects of new securities typically examine the effects of options or futures trading on the underlying stocks' liquidity measures, particularly the bid-ask spreads (see, for example, Jegadeesh and Subrahmanyam, 1993; Kumar et al., 1998; a review paper by Mayhew, 2000). A related strand of studies investigates the impact of the introduction of index ETFs on their portfolio securities. For example, Hegde and McDermott (2004) report that the Dow Jones Industrial Average ETF improved the liquidity of the portfolio securities and reduced the adverse-selection costs. Richie and Madura (2007) arrive at the same conclusions with the Nasdaq 100 ETF. Finally, using a sample of over 100 ETFs, Madura and Ngo (2008) report that their introduction significantly increased the trading volume of the component stocks.

2.4 Sample Description

To study the impact of the introduction of GLD on gold company stocks, I use a sample of firms that satisfy the following requirements. First, they were classified as belonging to the gold ores industry (SIC four-digit code: 1041) at the time of the introduction of GLD.[15] Companies in this industry are gold producers, and thus their stocks should be directly affected by GLD's introduction. Secondly, the companies in the sample were listed on either the New York Stock Exchange (NYSE) or the American Stock Exchange (AMEX), and were included in the CRSP database. I do not include companies listed on NASDAQ because the market structure of NASDAQ is different (i.e., a dealer market as opposed to an auction market in the case of NYSE and AMEX). The difference in market structure was shown to cause trading costs to be different (Huang and Stoll, 1996), which would make comparison across firms difficult. Thirdly, to ensure reliable estimates, I require that the stocks be traded every day in the sample period. Finally, the companies were not involved in a major confounding event during the sample period such as a merger/acquisition, a lawsuit, or a stock split/reverse stock split.

The sample period consists of a period of two months prior to the introduction of GLD (the pre-GLD period) and two months after the introduction (the post-GLD period). The relatively short sample period minimizes the possibility of confounding events.[16] As GLD quickly gained popularity after its introduction, I believe that the sample period is long enough to capture the effects of GLD on the trading of gold company stocks. To ensure that the effects are accurately captured, I omit ten trading days immediately before

[15] The description of companies with this SIC code is "Establishments primarily engaged in mining gold ores from lode deposits or in the recovery of gold from placer deposits by any method. In addition to ore dressing methods such as crushing, grinding, gravity concentration, and froth flotation, this industry includes amalgamation, cyanidation and the production of bullion at the mine, mill or dredge site." (Source: The United States Department of Labor's web site)

[16] I searched the ABI/Inform database for any news that could affect the gold industry and/or individual gold companies during the months surrounding GLD's introduction. I did not find any significant industry-wide event. I found three company-specific events. The three affected companies were excluded from the sample (see the next footnote).

and ten trading days immediately after the GLD introduction day. This is due to the possibility that during this period, traders may liquidate their holdings of gold stocks in order to move to GLD, and thus the trading activity of gold stocks during this period could be unusually high and not reflective of a normal condition. The results in this section still hold even if this period is included in the analysis, and are available upon request. I obtain transactions data from the New York Stock Exchange's Transactions and Quotes (TAQ) database. Price data and data used to calculate abnormal returns are from CRSP, while daily gold prices are obtained from Bloomberg.

In total, there are thirty-six companies in my sample.[17] Their summary statistics are reported in Table 2.1. In terms of size, the sample is considerably diverse. The market capitalizations (as of November 1, 2004) range from $51.7 million to $11.6 billion with a mean of $1.4 billion and a median of $653.9 million. This reflects the nature of the gold-mining industry, which consists of a few large companies and many smaller companies. To put the companies' market capitalizations in perspective relative to the size of GLD, recall from Section 2.2 that the assets under management of GLD after only a week in existence was approximately $1.46 billion (i.e., close to the 75th percentile of the market capitalization of gold company stocks). Accordingly, the introduction of GLD was a major event that could potentially affect the demand for gold company stocks.

[17] The number of companies in our sample is slightly smaller than that in other studies on gold mining companies. For example, there are forty-eight companies in Tufano (1996, 1998) and forty-four companies in Jin and Jorion (2007). This is due mainly to the criteria that I set for our sample. Two companies were omitted because they were listed on NASDAQ, while three others were excluded because they did not trade every day during the sample period. In addition, three more companies were omitted because of a major lawsuit, a reverse stock split, and an adverse state ballot result, respectively.

[Insert Table 2.1 here]

To get an idea about how these stocks co-move with gold prices, I calculate the correlation coefficients between the stocks' returns and gold returns over the period of three months ending ten trading days before my sample period. As expected, all correlation coefficients are positive. They range from 0.30 to 0.68, with a mean (median) of 0.52 (0.51). This suggests that gold company stocks respond positively to gold price movements, but, on average, they do not provide a pure play on gold. This is consistent with the fact that the performance of gold stocks depends not only on gold price, but also on other factors such as hedging policies, production costs and management ability.[18]

The correlations between the stocks' returns and the returns on the market (as proxied by the CRSP value-weighted market index) are low on average, with a mean (and median) of 0.26. This average is comparable to the number reported in Jaffe (1989) for the period between 1971 and 1987 (i.e., 0.30). The wide range of the correlation values (i.e., from –0.06 to 0.66) suggests that gold companies are diverse in their response to market factors.

Table 2.1 also provides a snapshot of the trading activity of the stocks of companies in the sample. The information on the numbers of trades and trading volume are from November 1, 2004. As with market capitalization, the trading activity varies substantially

[18] The divergence in performance between gold and gold stocks has been reported in, for example, Chua et al. (1990). Tufano (1998) and Jin and Jorion (2007) report that hedging significantly reduced gold stocks' sensitivity to gold price movements.

across firms in the sample. The average number of shares traded that day is 768,194 shares, while the standard deviation (876,685 shares) is larger than the mean.

2.5 Empirical Results

2.5.1 Basic Results – Liquidity Measures

As a first step in my investigation of the effects of the introduction of GLD on the trading characteristics of gold company stocks, I compare the stocks' measures of trading activity and liquidity between the pre-GLD and the post-GLD periods. The trading-activity measures that I examine are as follows:

1. Number of trades
2. Trading volume (in both shares and dollar values)
3. Relative trading volume, defined as the ratio between (i) the stock's normalized trading volume (i.e., number of shares traded divided by the stock's number of shares outstanding) and (ii) the equally-weighted normalized trading volume of all stocks traded on the NYSE and AMEX on the same day (see Appendix 2.1 for a formal description). As defined, relative trading volume takes into account a possible market-wide trend in trading volume.
4. Sell-vs-buy volume ratio, calculated as the ratio between seller-initiated trading volume and buyer-initiated trading volume, where trades are classified as sells or buys using the techniques developed by Lee and Ready (1991), which is

standard in the market microstructure literature (see Appendix 2.1 for a description of the technique).

For liquidity measures, I examine bid-ask spreads and trade depths. I use two definitions of bid-ask spreads. They are effective spread (ES) and relative effective spread (RES). Effective spread is defined as twice the absolute difference between the trade price and mid-point of the bid-ask quote at the time of the trade. This measure takes into account the fact that trades often occur at prices inside the posted spreads, and so a measure of spreads based on quoted bid and ask prices may not accurately reflect market liquidity and transaction costs faced by investors (Petersen and Fialkowski, 1994). Relative effective spread is effective spread expressed as a percentage of the mid-point of the quote. For each day, I volume-weight effective spreads and relative effective spreads, where the weights are the number of shares in each trade during the day (see formal descriptions in Appendix 2.1).

Trade depth is the amount of trade that can be done at the quoted bid and ask prices. It captures the quantity dimension of liquidity, which is another piece of information that liquidity providers (e.g., market makers) use to manage information risk (e.g., Lee et al., 1993). I measure trade depth both in terms of number of shares and in dollar values (see Appendix 2.1 for formal descriptions).

The bid-ask spreads and trade depth are calculated using TAQ data. I delete all quotes and transactions data outside the NYSE trading hours (9:30 A.M to 4:00 P.M.), and disregard the first trade of each day to remove the overnight demand and news effects.

Commonly used filters are applied to the data to remove observations that can be subject to errors or related to irregular transactions. For example, only quotes that were eligible for inclusion in the National Best Bid or Offer (NBBO) calculation (i.e., those with quote conditions of 01, 02, 06, 12 and 23) are considered. Only trades that were not corrected, changed, or signified as cancel or error (i.e., correction indicator = 0) are included. Other filters include removing observations with negative bid, ask or transaction prices, and those with bid prices greater than ask prices, etc.

To match trades with quotes, I use the Lee and Ready's (1991) five-second rule (where each trade is matched with the most recent quote that occurred at least five seconds before the trade timestamp on the same day). More recent studies argue that the improvement in technology and information transmission has reduced the time delay between the submission of quotes data and the submission of transactions data. For example, Henker and Wang (2006) propose a one-second rule, and show that it outperforms the five-second rule in the estimation of components of bid-ask spreads. For robustness, I also perform my tests and estimation using the one-second rule. The results are qualitatively similar to those obtained by the five-second rule. Hence, to save space, I will only present the results under the five-second rule.

For each day in the sample period (i.e., thirty-four trading days in the pre-GLD period and thirty-four trading days in the post-GLD period), I calculate the trading-activity measures and the liquidity measures for each stock. I then take the average of each measure at the company level for the pre-GLD period and the post-GLD period. Next, I calculate the "Post/Pre ratio" for each variable as follows:

$$\text{Post/Pre Ratio}_i = \frac{\overline{X}_{i,post}}{\overline{X}_{i,pre}} \tag{2.1}$$

where $X_{i,pre}$ and $X_{i,post}$ are the variable of interest for stock *i* in pre-GLD and post-GLD periods respectively. I perform a Student's *t*-test on the Post/Pre ratio to determine whether the sample mean of the ratio is significantly different from unity. Since the normal distribution assumption of the *t*-test may be violated, I also employ a signed rank test.

I also examine the holdings by institutional investors in gold company stocks. If uninformed investors migrated to GLD, I should observe an increase in institutional investors' holdings. I collect the holdings information from the Thomson-Reuters Institutional Holdings (13F) Database. The data are based on form 13F, which investment companies and professional managers whose assets under management are over $100 million are required to file with the SEC on a quarterly basis. As GLD was introduced in November 2004, I compare the holdings on September 30, 2004 with the holdings on December 31, 2004. For each company, I calculate the ratio of the percentages of shares held by institutional investors and also the ratio of the numbers of institutional investors on the two dates (i.e., Post/Pre ratio).

Table 2.2 reports the estimates of the trading-activity measures (Panel A), the liquidity measures and the holdings by institutional investors (Panel B). In Panel A, the number of trades and all three measures of trading volume show a decline (i.e., Post/Pre ratio < 1) after the introduction of GLD. All the declines are significant, especially for relative trading volume, which already accounts for the market-wide trend in trading volume. The Post/Pre ratios suggest that, on average, trading volume declines by approximately 14% in dollar term and 19% in relative term. In addition, the decline occurs in most of the firms, as only about 28% (14%) of the firms have an increase in dollar trading volume (relative trading volume).

The sell-vs-buy volume ratio increases significantly in the post-GLD period. The mean (median) of its Post/Pre ratio is 1.095 (1.111), indicating that, on average, the sell activity (as normalized by the buy activity) increases by about 10%. The increase occurs in two-thirds (i.e., 67%) of the firms in my sample. I interpret this result as being consistent with the prediction that the demand for gold company stocks would drop after the introduction of GLD.

[Insert Table 2.2 here]

In Panel B, both of the bid-ask spread measures increase significantly in the post-GLD period. The mean (median) Post/Pre ratio of effective spread is 1.103 (1.059), while the mean (median) Post/Pre ratio of relative effective spread is 1.157 (1.174). In other words, the relative bid-ask spread increases by over 15% on average. The proportion of the sample that experiences an increase in bid-ask spread measures is also high – about 72% in the case of effective spread and 81% in the case of relative effective spread.

As for trade depth, in terms of shares, both the mean and median of its Post/Pre ratios are smaller than, but not significantly different from, unity. However, trade depth in terms of dollars, which is arguably a more economically meaningful measure of depth, declines significantly. The mean (median) of its Post/Pre ratios is 0.925 (0.870), both of which are significantly different from 1. For both measures of depth, the proportion of the sample with ratio greater than unity is less than 40%, suggesting that the decline in trade depth happens to the majority of the companies in the sample.

The (percentage) holdings by institutional investors also increase significantly in the post-GLD period. The average (across companies) of Post/Pre ratio is 1.099, which is significantly different from 1 at the 5% level. The increase occurs in about 70% of the firms in the sample. I also calculate the Post/Pre ratios of the number of institutional investors in each stock. The average of this ratio is 1.123, which is significantly different from 1 at the 1% level. Both results indicate that there is an increase in institutional holdings of gold company stocks, both in terms of the percentage of shares and the number of investors, after GLD's introduction.

In summary, the results in Table 2.2 indicate that the majority of the gold companies in the sample experience significant deterioration in trading activity and liquidity after the introduction of GLD. In particular, their bid-ask spreads and holdings by institutional investors increase, while trade depth declines. The findings are consistent with the adverse-selection argument, which predicts a migration of uninformed traders to GLD. The findings do not support the arbitrage argument or the market-making argument.

Finally, I note that prior studies have shown that bid-ask spreads depend on return volatility, price levels and trading volume (e.g., Lee et al., 1993; Jegadeesh and Subrahmanyam, 1993; Boehmer and Boehmer, 2003). To rule out the possibility that changes in these three factors, rather than the introduction of GLD, cause the observed changes in the spreads, I follow Jegadeesh and Subrahmanyam (1993) and run a log-linear regression of bid-ask spreads on the three factors and a dummy variable. I want to know whether the observed increase in spreads still exists after controlling for the changes in these factors.

Specifically, I run the following regression:

$$\begin{aligned} Ln\,Spread_{i,t} &= \beta_0 + \beta_1 \times Dummy + \beta_2 \times Ln\,Volume_{i,t} \\ &+ \beta_3 \times Ln\,Std_{i,t} + \beta_4 \times Ln\,Price_{i,t} + \varepsilon_{i,t}, \end{aligned} \qquad (2.2)$$

where the index *i* represents the firms in the sample (*i* = 1, 2,…, 36) and the index *t* represents the days in the pre-GLD and post-GLD periods (*t* = 1, 2,…,68). $Ln\,Spread_{i,t}$ is the natural log of effective spread or relative effective spread, as the case may be. $Dummy$ takes a value of 1 in the post-GLD period and 0 in the pre-GLD period. $Ln\,Volume_{i,t}$ is the natural log of the daily trading volume (in shares), and $Ln\,Std_{i,t}$ is the natural log of the daily return standard deviation estimated by the extreme value method of Parkinson (1980).[19] $Ln\,Price_{i,t}$ is the natural log of the stock's closing price. I expect the coefficient for $Dummy$ to be positive and significant if the bid-ask spreads increase in the post-GLD period after controlling for the other factors.

To correct for the autocorrelation and heteroscedasticity in standard errors, I use the Newey-West (1987) procedure. However, since my sample firms are from the same

[19] According to Parkinson (1980), the standard deviation of daily returns is estimated as:

$$Std = \sqrt{\frac{\left[ln\left(Price\_High\right) - ln\left(Price\_Low\right)\right]^2}{4 \times ln(2)}} \ ,$$

where *Price_High* and *Price_Low* are the daily highest and lowest transaction prices, respectively.

industry, I also account for possible correlation of regression disturbances between companies by using two other approaches. First, I allow for cross sectional correlation of standard errors by using the approach proposed in Kmenta (1986). Secondly, I adjust the standard errors by using the approach in Driscoll and Kraay (1998), which is expected to eliminate some deficiencies of the Kmenta approach.[20]

The regression results are presented in Table 2.3.[21] The results are similar across the three standard error approaches. The coefficient for *Dummy* is positive and significant for both definitions of dependent variables. The coefficients for the three control variables are significant and have the anticipated signs.[22] This confirms that gold company stocks have higher bid-ask spreads in the post-GLD period after controlling for changes in trading volume, return volatility and share prices.

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[20] Beck and Katz (1995) point out that in some cases, the Kmenta standard error estimates can be unacceptably low.

[21] Under the Newey-West and the Driscoll and Kraay approaches, there are 2,438 firm-day observations in the regressions. This number is 10 fewer than the full complement (i.e., 36 firms x 68 days). The 10 missing firm-day observations come from three companies. Under the Kmenta approach, there are 2,244 firm-day observations in the regressions. This is because the Kmenta approach required balanced data, which are not possible for the three companies. As a result, the three companies were removed from the Kmenta regressions.

[22] The literature on bid-ask spreads posits that spreads are determined by three different costs of market makers – order-processing cost, inventory cost and adverse-selection cost (i.e., losses to informed traders). Spreads should decline in trading volume because it allows market makers' fixed costs to be spread over a larger base, and also provides market makers with more flexibility in managing their inventory imbalances. Spreads should increase in return volatility because higher volatility increases inventory risk and also the potential losses to informed traders. As for the expected relationship between spreads and price, the relationship depends on whether spreads are measured in dollar term or percentage term. In dollar term, high-price stocks should have higher spreads because the inventory cost and the amounts of potential losses to informed traders are larger. In percentage term, however, high-price stocks should have lower percentage spreads because, for a given number of shares traded, a higher price means a higher dollar trading volume, which allows fixed cost to be spread over a larger base. For a discussion on spread components, see, for example, Stoll (1978), Glosten and Milgrom (1985) and Huang and Stoll (1997). For a discussion on the relationship between spreads and trading volume, volatility and price, see, for example, Copeland and Galai (1983) and Jegadeesh and Subrahmanyam (1993).

[Insert Table 2.3 here]

2.5.2 Estimation of the Adverse-Selection Component

The adverse-selection argument predicts that the introduction of GLD would attract uninformed traders away from gold company stocks. As a result, the stocks' bid-ask spreads should increase due, in particular, to an increase in the adverse-selection cost that market makers face. In this section, I investigate whether the increase in the bid-ask spreads reported in the previous section can be attributed to higher adverse-selection cost. To do so, I employ two approaches that have been used in the literature to estimate the adverse-selection component of bid-ask spreads. The first approach is proposed by Madhavan et al. (1997), while the second approach is from Huang and Stoll (1996).

Under the Madhavan et al. (1997) approach (henceforth referred to as "MRR"), bid-ask spreads are decomposed into a non-information component (which includes order-processing cost and inventory cost) and an information component (adverse-selection cost). In their model, price changes because market makers continuously revise their beliefs about the stock's fundamental value based on new public information and observed order flows (which may reflect traders' private information). Accordingly, one can estimate the adverse-selection cost that market makers face by using a time series of changes in transaction prices. Formally, changes in price are modeled as:

$$P_t - P_{t-1} = \alpha + (\phi + \theta)x_t - (\phi + \rho\theta)x_{t-1} + \varepsilon_t + \xi_t - \xi_{t-1} \quad (2.3)$$

where P_t is the transaction price at time t, α is a constant drift (if any) in price, ϕ is the order-processing cost parameter, and θ is the adverse-selection cost parameter. x_t is an indicator variable for trade initiation, which takes the value of +1 if trade at time t is buyer-initiated, –1 if seller-initiated and 0 otherwise (e.g., a mid-quote transaction). ρ is the first-order autocorrelation of the trade initiation variable, while ε_t denotes the innovation in beliefs between time $t-1$ and time t because of new public information, and ξ_t is the error term that captures the effect of errors induced by price discreteness or possibly time-varying returns.

My parameters of interest are the two cost parameters, ϕ and θ, in the pre-GLD and post-GLD periods. To estimate them, I use the methodology in Armstrong et al. (2011), where the dependent variable is deflated by lagged price (i.e., P_{t-1}) to allow for cross-sectional comparability (as estimated ϕ and θ will be in percentage term). The estimation is done using OLS. To determine trade initiation, I match trades and quotes using the Lee and Ready (1991) method with the 5-second rule.[23] A trade is classified as a buy order (i.e., $x_t = +1$) if it occurs at a price above the quote mid-point, and a sell order (i.e., $x_t = -1$) if it occurs at a price below the quote mid-point. For transactions taking place at the quote mid-point, I assign 0 to x_t. As a by-product of the estimation procedure, I also obtain the estimate for effective spread. This estimate is based only on transaction prices, and so it is

[23] As before, I also use the 1-second rule. The results are qualitatively similar.

different from the commonly used definition, which is with respect to the mid-quote (See Section 2.5.1). For this reason, I will refer to this estimate as MRR effective spread.[24]

The second approach that I use to estimate the adverse-selection component of bid-ask spreads is from Huang and Stoll (1996). This approach decomposes effective spread into realized spread and price impact. Huang and Stoll argue that due to the existence of informed traders, prices usually move against market makers after a trade, falling after a seller-initiated transaction (i.e., a market maker purchase) and rising after a buyer-initiated transaction (i.e., a market maker sale). As a result, market makers usually do not realize the effective spread because of losses to informed traders. The profit (loss) of market maker is actually the difference between the initial transaction price and the subsequent transaction price at which the trade is liquidated. They define this difference as realized spread, which measures the actual post-trade revenues earned by the market maker, and define the difference between effective spread and realized spread as price impact, which estimates the amount that market makers lose to informed traders (i.e., adverse-selection cost).

Based on this premise, I define relative realized spread as:

$$RRS_t = 2I_t \frac{(P_t - P_{t+n})}{M_t} \tag{2.4}$$

[24] The MRR effective spread is equal to $(1-\lambda)(2\phi+\theta)$, where λ is the probability that a transaction occurs at the quote mid-point.

where I_t is an indicator variable whose value equals +1 if the trade at time *t* is buyer-initiated and –1 if seller-initiated, P_t is the transaction price at time *t*, P_{t+n} is the first transaction price observed at least *n* minutes after time *t* within the same trading day, and M_t is the mid-quote at time *t* (i.e., the half-way point between the best bid and ask at time *t*). Subtracting relative realized spread from relative effective spread (as previously defined), I obtain relative price impact (in percentage term) as:[25]

$$PRICE\ IMPACT_t = 2I_t \frac{\left(P_{t+n} - M_t\right)}{M_t} \tag{2.5}$$

Following Huang and Stoll, I estimate relative realized spread with *n* equal to 5 and 30 minutes. Since the two cases provide similar and consistent results, I only present the results with *n* of 5 minutes. Volume-weighted relative realized spread and relative price impact are calculated on a daily basis for each stock. Then, for each stock, these daily values are averaged for the pre-GLD period and the post-GLD period.

Table 2.4 reports the estimates of bid-ask spread components before and after the introduction of GLD, and the results of the tests whether those components change significantly between the two periods. Panel A presents the results based on the MRR approach. The MRR effective spread (in percentage term) increases significantly in the post-GLD period, with mean (median) Post/Pre ratio of 1.069 (1.092). The Post/Pre ratio

[25] As defined in Section 2.5.1 and also in the Appendix 2.1, relative effective spread is equal to twice the absolute value of the difference between the trade price and the mid-quote at the time of trade, expressed as a percentage of the mid-quote. For the purpose of this section, that definition is equivalent to: $RES_t = 2I_t(P_t - M_t)/M_t$.

is greater than 1 for about 70% of the companies in the sample. This increase is consistent with the results in Table 2.2, where relative effective spread is calculated based on the commonly used definition. The estimates of the non-information and the adverse-selection costs (i.e., ϕ and θ) show that the increase in bid-ask spreads is due mainly to the increase in the adverse-selection cost. The mean and median Post/Pre ratio of θ are 1.097 and 1.099, both of which are significantly different from unity. On the other hand, I do not observe any significant changes in the non-information component. The mean and median Post/Pre ratio of ϕ are not significantly different from 1 under either the *t*-test or the signed rank test.

[Insert Table 2.4 here]

Panel B of Table 2.4 shows that the results under the Huang and Stoll's (1996) approach are consistent with the results under the MRR approach. The price impact (i.e., adverse-selection cost) rises significantly after the introduction of GLD. The mean (median) its Post/Pre ratio is 1.334 (1.230), both of which are significantly different from unity at the 1% level. The price impact is higher for two-thirds of the firms in the sample. On the other hand, the relative realized spreads do not change significantly, indicating that the actual profit of market makers does not change significantly. In other words, the widening of bid-ask spreads is primarily the result of market makers requiring more compensation for greater information risk.

In summary, the results in Table 2.4 are consistent with the adverse-selection argument, which suggests that uninformed traders migrate to GLD due to its low adverse-selection risk and the pure-play on gold that it offers. This migration leads to a larger proportion of informed traders in gold company stocks and thus higher adverse-selection compensation required by market makers. This causes the bid-ask spreads of gold company stocks to widen in the post-GLD period.

2.5.3 Robustness Tests

In this section, I conduct robustness tests to rule out the possibility that my results are caused by market-wide or industry-wide factors rather than the introduction of GLD.

A. Whether the reported changes in spreads were due to variations that occurred in the market during the sample period

I address this issue in two ways. First, to get a rough idea of how the liquidity of the overall market changes during the sample period, I calculate the Amihud illiquidity measure (Amihud, 2002) for all the stocks traded on the NYSE or AMEX (as reported in the CRSP database) during the Pre- and Post-GLD periods (as defined in the chapter). The Amihud illiquidity measure is a widely-used proxy for illiquidity, and is calculated as the average of the daily values of the ratio between (i) the absolute value of the stock's daily return and (ii) its dollar trading volume of that day; i.e.,

$$ILLIQ_{it} = \frac{1}{T}\sum_{t=1}^{T}\frac{|r_{it}|}{VOLD_{it}}, \quad (2.6)$$

where r_{it} and $VOLD_{it}$ are stock i's return and dollar trading volume on day t respectively, and T is the number of days in the sample period. Amihud (2002) interprets the measure as the average daily price response associated with one dollar of trading volume, and so the measure serves as a rough estimate of price impact of trade. The higher the measure, the higher the price impact of trade (and thus the more illiquid the stock). For each stock, I calculate the measure for the Pre-GLD period and the Post-GLD period, and then calculate the Post/Pre ratio of the measure. In total, there are over 3,400 stocks in the calculations. Next, I test whether the mean and median (across stocks) of the Post/Pre ratios are significantly different from 1. If the market as a whole became more illiquid (i.e., less liquid) in the Post-GLD period, the mean/median of the Post/Pre ratios should be greater than 1 (i.e., the illiquidity measure is greater in the Post-GLD period than in the Pre-GLD period).

I find that the mean of the Post/Pre ratios is 0.973, which is not significantly different from 1. The median of the Post/Pre ratios is 0.830 and is significantly different from 1. Because both the mean and median of the Post/Pre ratios are less than 1, the results indicate that the market as a whole did not become more illiquid in the Post-GLD period. If anything, it tended to be less illiquid (i.e., more liquid).

Secondly, I compare the changes in spreads of gold company stocks to those of matching companies' stocks. The matching companies come from a universe of NYSE and AMEX listed companies (as reported in the CRSP database). For each gold company, I select a matching company that is closest to it based on three characteristics – price, trading volume and return volatility. As mentioned earlier, these three characteristics have been shown to influence levels of bid-ask spreads. Specifically, I use the approach in Huang and Stoll (1996) to identify the matching company as one that minimizes the following score:

$$\sum_{i=1}^{3}\left(\frac{X_i^G - X_i^M}{(X_i^G + X_i^M)/2}\right)^2, \qquad (2.7)$$

where X_i is one of the above three characteristics, and the superscripts G and M refer to the gold company and the matching company respectively.

I then examine whether the bid-ask spreads and the adverse-selection component of the gold company stocks changed *relative to* those of their matching companies' stocks during my sample period. I use the difference-in-difference approach. First, I calculate the differences in spreads and adverse-selection component between the gold companies and the matching companies (e.g., gold company spreads – matching company spreads) for the Pre- and Post-GLD periods respectively. Then, I calculate and test the differences between the Pre- and Post-GLD differences (i.e., Diff-in-Diff = Post – Pre values). This approach removes the biases that can be caused by the permanent differences between the two groups, and also the biases from market-wide changes over time (e.g., trends). If the observed changes in bid-ask spreads of gold stocks reported in Section 2.5.1 are caused by market-wide trends or some unobservable factors that may affect companies with similar characteristics (in terms of spreads), I expect the mean and median of the Diff-in-Diff values to not be significantly different from zero.

The results are shown in Table 2.5 below. Both the mean and median Diff-in-Diff values for effective spreads and relative effective spreads are positive and significantly different from zero, suggesting that the bid-ask spreads of the gold company stocks increased relative to those of the matching companies stocks in the Post-GLD period. The same is true for the adverse-selection cost, θ, as measured using the Madhavan, Richardson and Romans (1997) approach. For the price impact, as measured using the Huang and Stoll (1996) approach, both the mean and the median are positive. However, only the median is significant.

[Insert Table 2.5 here]

In sum, the evidence supports the argument that the changes in the spreads of gold company stocks reported in Section 2.5.1 are not associated with the market-wide variations or some possible unobservable factors that may affect companies with similar characteristics (in terms of spreads) during the sample period.

B. Whether the reported changes in spreads were due to industry-wide variations during the sample period

Next, I test whether the reported results still hold after controlling for industry-wide liquidity movements (i.e., common to all metal-mining firms) during the sample period. I examine whether the bid-ask spreads of gold company stocks changed *relative to* the spreads of stocks of other metal-mining companies during the Post-GLD period, after controlling for factors that are known to influence bid-ask spreads. These other metal-mining companies shared the same SIC two-digit code as that of gold companies (i.e., SIC two-digit code = 10).[26] In total, there were 20 such companies listed on the NYSE or AMEX (as reported in the CRSP database) in November 2004.

[26] These include firms operating in the iron ores, copper ores, lead and zinc ores, silver ores, ferroalloy ores (except vanadium), metal mining services and miscellaneous metal ores industries.

Specifically, I modify the panel regression equation that I use on the 36 gold companies in Section 2.5.1 (Eq. (2.2)) to include the 20 other metal-mining companies (so that there are 56 companies in total), as follows:

$$\begin{aligned} Ln\ Spread_{i,t} &= \beta_0 + \beta_1 \times Dummy + \beta_2 \times Gold_i \\ &+ \beta_3 \times Dummy \times Gold_i + \beta_4 \times Ln\,Volume_{i,t} \\ &+ \beta_5 \times Ln\ Std_{i,t} + \beta_6 \times Ln\ Price_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{2.8}$$

where the index i represents the gold and other metal-mining companies (i = 1, 2,…, 56), and the index t represents the days in the Pre-GLD and Post-GLD periods (t = 1, 2,…,68). $Ln\,Spread_{i,t}$ is the natural log of effective spread or relative effective spread, as the case may be. $Dummy$ takes a value of 1 in the Post-GLD period and 0 in the Pre-GLD period. $Gold_i$ is a dummy variable that equals 1 if company i is a gold company and 0 otherwise. $Ln\,Volume_{i,t}$ is the natural log of the daily trading volume (in shares), and $Ln\ Std_{i,t}$ is the natural log of the daily return standard deviation estimated by the extreme value method of Parkinson (1980). $Ln\ Price_{i,t}$ is the natural log of the stock's closing price. The latter three independent variables are control variables.

The coefficient of interest is β_3 (for the $Dummy \times Gold_i$ interaction term). It captures the changes in the bid-ask spreads of gold company stocks *relative to* the changes in the spreads of other metal-mining companies' stocks during the Post-GLD period, after controlling for factors that influence bid-ask spreads.[27] If the findings for gold companies reported in Section 2.5.1 were *not* influenced by industry-wide trends, I expect β_3 to be significantly different from zero. Due to the reasons mentioned earlier, I use three different approaches to correct for the autocorrelation, cross sectional correlation, and heteroscedasticity in standard errors.

The regression results are shown in Table 2.6. The results are similar across the three standard error approaches. β_3 is positive and significant for both definitions of the dependent variable. The coefficients for the three control variables are significant and have the anticipated signs. The results show that, compared with stocks in other metal-mining industries and after controlling for factors that may affect stocks' liquidity, gold stocks' bid-ask spreads increased significantly after GLD's introduction.

[Insert Table 2.6 here]

2.5.4 The Relationship between Firm Size and the Effect of GLD

In this subsection, I examine the relationship between firm size and the observed effect of GLD. My premise is that larger firms are more visible to the public and thus attract a greater number of investors, especially uninformed ones (e.g., Grullon et al., 2004; Barber and Odean, 2008). Therefore, there could be a larger migration of uninformed

[27] In the above regression equation, the coefficient β_1 (for the variable *Dummy*) captures the changes in spreads common to all firms during the Post-GLD period, while the coefficient β_2 (for the variable *Gold*) captures the time-invariant spread difference between gold firms and other metal-mining firms.

investors from the stocks of these firms to GLD, and thus the effect on these stocks should be greater.

I use two proxies for firm size and visibility – market capitalization and the amount of analyst coverage. The latter proxy reflects the fact that analyst coverage increases stocks' media exposure and helps uninformed investors to become familiar with the stocks. I run a regression of the Post/Pre ratios of liquidity measures (effective spreads and relative effective spreads) and adverse-selection component measures (MRR's adverse-selection cost and Huang and Stoll's price impact) on each proxy and the correlation between the returns on each gold company stock and gold returns. I include this correlation as an independent variable of the regression to control for the fact that hedging policies typically vary across firms, and thus the sensitivity of their stocks to gold price movements is different. The difference in sensitivity can influence investors' migration decision (e.g., investors may have more incentive to migrate from stocks that poorly track gold price movements.).

The coefficient estimates, together with their White's heteroscedasticity-consistent standard errors, are presented in Table 2.7. The results show that all of the dependent variables are significantly positively related to either proxy for firm size and visibility. On the other hand, the estimated coefficient for the correlation between gold stock returns and gold returns is not significant. The results suggest that the impact of GLD's introduction is more significant on companies with relatively more uninformed traders, and support the argument that GLD affects gold company stocks through migration of investors, especially uninformed investors.

[Insert Table 2.7 here]

2.5.5 The Impact on Gold Mutual Funds

I also examine the effects of GLD's introduction on gold-oriented mutual funds. Gold mutual funds provide diversification benefits, and the adverse-selection risk is reduced. Also, mutual-fund investors pay management fees in order to benefit from fund managers' knowledge and expertise. That is, mutual-fund investors pay fund managers to be informed on their behalf. As a result, uninformed investors in gold mutual funds do not have as strong incentive to migrate to GLD as do uninformed investors in gold stocks. I expect the effects of GLD's introduction to be less strong on mutual funds than on individual gold stocks.

I examine 41 gold mutual funds during the month of GLD's introduction and subsequent months. The 41 funds are classified in CRSP US Survivor-Bias-Free Mutual Funds database as having the Lipper Objective of being gold-oriented funds. I compare their actual capital flows to their expected capital flows during the month of GLD's introduction (November 2004) and subsequent months. In order to have reliable estimates of their expected capital flows, I require that the funds be introduced to the market at least 30 months before GLD started trading (i.e., before May 2002).

To estimate the funds' expected capital flows, I follow Coval and Stafford (2007). First, I define the *actual* capital flows to mutual fund *k* during month *t*, $flow_{k,t}$, as:

$$flow_{k,t} = \frac{Flow_{k,t}}{TNA_{k,t-1}}, \tag{2.9}$$

$$\text{where } Flow_{k,t} = TNA_{k,t} - TNA_{k,t-1} \times (1 + R_{k,t}). \tag{2.10}$$

$TNA_{k,t}$ is the CRSP total net asset value of fund *k* at the end of month *t*, and $R_{k,t}$ is the return on fund *k* over month *t*.

Next, I run the following panel regression using the monthly gold mutual fund data from November 2002 to October 2004 (i.e., two years before GLD's introduction):

$$\begin{aligned} flow_{k,t} = \alpha + \sum_{m=1}^{3} \beta_m \times flow_{k,t-m} + \sum_{n=1}^{3} \gamma_n \times R_{k,t-n} \\ + \psi \times R_{M,t} + \phi \times R_{G,t} \end{aligned} \tag{2.11}$$

I add market returns in month *t* (i.e., the concurrent month), $R_{M,t}$, and gold returns in month *t*, $R_{G,t}$, as independent variables to Coval and Stafford's (2007) model to control for the possibility that the funds' capital flows could be influenced by concurrent market and gold price movements. Expected capital flows of mutual funds are then calculated as the fitted values using the estimated coefficients. Abnormal capital flows are defined as the difference between the actual capital flows and the expected capital flows.

On average, the abnormal capital flows of the gold mutual funds are -2.24% and -2.99% of their total net asset values for the month in which GLD was introduced (November 2004) and the month after (December 2004) respectively. The results indicate that gold mutual funds experienced some abnormal flow activity after GLD was introduced. However, the impact of GLD on these funds did not appear to be very strong.

2.6 Conclusions

In this chapter, I study the market impact of a very successful financial innovation. The innovation is the SPDR Gold Trust exchange-traded fund (Tic: GLD), which is the first bullion-backed exchange-traded fund introduced in the U.S. market. GLD holds physical gold, and provides traders with a convenient and cost-effective way to gain exposure to gold. Using a sample of gold company stocks traded in the U.S. market when GLD was introduced, I find that the liquidity of gold company stocks declined and their adverse-selection risk increased after GLD's introduction. Over the two-month period after GLD's introduction, the stocks' relative effective bid-ask spreads increased by more than 15%, while their adverse-selection cost, as measured by the price impact of trades, went up by over 30%. Their trading volume (both in terms of shares and dollars) also significantly declined. The findings support the conjecture that GLD, being a less information-sensitive security, attracted traders, especially uninformed traders, away from gold company stocks.

The results indicate that the introduction of a new security can have a serious adverse impact on existing related securities. My findings provide evidence from a new context to the empirical literature on the market impact of financial innovation, which typically concentrates on the effects of options and futures contracts on their underlying securities.

The observed decrease in gold stocks' liquidity is in contrast to the results reported in studies on the effects of index ETFs on their constituent stocks. I believe that this is due to the fact that GLD attracted traders away from gold company stocks, while index ETFs needed to trade the constituent stocks. Accordingly, one cannot assume that the experience in one market will carry over to another.

My results also contribute to the recently emerging literature on the securitization of commodities. The findings show that the securitization of commodities can have a negative effect on the stocks of commodity companies if the new securities attract investors away from the stocks.

Appendix 2.1: Definitions of Trading-Activity and Liquidity Measures

This appendix contains formal definitions of some of the trading-activity measures and liquidity measures used in this paper.

1. Relative Trading Volume (*RTV*):

For each day, I calculate stock *i*'s relative trading volume (RTV_i) as follows:

$$RTV_i = \frac{\frac{TV_i}{SHARE_i}}{\sum_{i=1}^{I} \frac{1}{I} \times \frac{TV_i}{SHARE_i}} \tag{A.2.1}$$

where TV_i is stock *i*'s trading volume for that day and $SHARE_i$ is stock *i*'s number of shares outstanding on the same day.

2. Sell-vs-Buy Volume Ratio

For each day, I calculate stock *i*'s sell-vs-buy volume ratio as the ratio between seller-initiated trading volume and buyer-initiated trading volume, where trades are classified as sells or buys using the algorithm developed by Lee and Ready (1991). Specifically, I match each trade with the most recent quote that occurred at least five seconds before the trade time stamp on the same day. Trades are classified as buys (sells) if they occur above (below) the mid-point of the bid and ask quotes.

3. Effective Spread (*ES*):

The daily effective spread (*ES*) is the volume-weighted average of twice the absolute difference between the trade price and mid-point of the quotes at the time of the trade:

$$ES = \frac{2 \times \sum_{j=1}^{n} \left| P_j - Mid_j \right| \times Q_j}{\sum_{j=1}^{n} Q_j} \tag{A.2.2}$$

where P_j is the *j*th trade of the day, Mid_j is the mid-point between the best bid and the best ask quotes associated with trade *j* (i.e., $0.5 \times ASK_j + 0.5 \times BID_j$), and Q_j is the number of shares traded in trade *j*.

4. Relative Effective Spread (*RES*):

Relative effective spread (*RES*) is effective spread expressed as a percentage of the mid-point of the quotes. The relative effective spreads are then volume-weighted for each day.

$$RES = \frac{2 \times \sum_{j=1}^{n} \left| P_j - Mid_j \right| / Mid_j \times Q_j}{\sum_{j=1}^{n} Q_j} \tag{A.2.3}$$

where P_j, Mid_j and Q_j are as defined above.

5. Trade Depth (*DEP*):

Trade depth (*DEP*) is defined as the equally weighted average of the depths during a trading day and I calculate the depths in both share term (*DEP_SHARE*) and dollar term (*DEP_DOLLAR*):

$$DEP\_SHARE = \frac{\sum_{j=1}^{n}(ASK\_SHARE_j + BID\_SHARE_j)}{n} \tag{A.2.4}$$

$$DEP\_DOLLAR = \frac{\sum_{j=1}^{n}(ASK_j \times ASK\_SHARE_j + BID_j \times BID\_SHARE_j)}{n} \tag{A.2.5}$$

where ASK_SHARE_j is the number of shares at best ASK_j and BID_SHARE_j is the number of shares at best BID_j.

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Table 2.1

Summary statistics

Table 2.1 provides summary statistics for sample firms. It contains the means, standard deviations, maximums, 75th percentiles, medians, 25th percentiles and minimums of the firm characteristics for sample firms. The following are firm characteristic descriptions. Market Cap is the product of the stock's closing price and number of shares outstanding. Gold Correlation is the correlation between the daily returns on gold company stocks and the daily returns on gold. Market Correlation is the correlation between the daily returns on gold company stocks and the daily returns on the CRSP value-weighted market index. The period used to calculate the correlations is three months ending ten trading days before my event window. Price is the closing prices of gold company stocks. Number of Trades is the total number of trades between 9:30 A.M. and 4:00 P.M. of the day. Trading Volume is the total number of trading volume between 9:30 A.M. and 4:00 P.M. of the day. Statistics of Market Cap, Price, Number of Trades and Trading Volume are based on data as of November 1, 2004.

Variable	Mean	Std	Max	P75	Median	P25	Min
Market Cap ($ 000s)	1,409,895	2,478,716	11,628,214	1,424,578	653,888	127,598	51,748
Gold Correlation	0.516	0.097	0.680	0.588	0.507	0.453	0.297
Market Correlation	0.264	0.164	0.663	0.394	0.262	0.154	-0.057
Price ($)	8.228	9.649	36.810	12.775	3.755	1.575	0.690
Num of Trades	694.9	782.5	3059.0	1237.5	288.0	97.5	5.0
Trading Volume (shares)	768,194	876,685	3,543,200	1,060,800	450,850	175,950	2,900

Table 2.2

Changes in trading characteristics and liquidity measures

Table 2.2 reports the mean (across firms) and median values of trading characteristics (Panel A), liquidity measures and holdings by institutional investors (Panel B) in the pre-GLD period and the post-GLD period. It also contains the mean and median values of the Post/Pre ratios of these measures, and the Student's *t* and signed rank test results of whether the ratios equal unity. Relative Trading Volume is the ratio between (i) the stock's normalized trading volume (i.e., number of shares traded divided by the stock's number of shares outstanding) and (ii) the equally-weighted normalized trading volume of all stocks traded on the NYSE and AMEX on the same day; Sell-vs-Buy Volume Ratio is the ratio between seller-initiated trading volume and buyer-initiated trading volume; Effective Spread is defined as twice the absolute difference between the trade price and mid-point of the bid-ask quotes at the time of the trade; Relative Effective Spread is effective spread expressed as a percentage of the mid-point of the quotes. For each day, I volume-weight effective spreads and relative effective spreads, where the weights are the number of shares in each trade during the day; Trade Depth (in shares) and Trade Depth (in dollars) are the equally weighted average daily depths in share term and dollar term respectively; Institutional Investors (%) is the percentage of shares held by 13F institutional investors; Institutional Investors (Number) is the number of 13F institutional investors who invested in the gold stock. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

Panel A:

Variable	Number of Trades	Trading Volume (shares)	Trading Volume ($)	Relative Trading Volume	Sell-vs-Buy Volume Ratio
Mean Pre	778.7	904,398	10,257,464	1.066	1.398
Mean Post	755.0	792,158	8,695,316	0.817	1.415
Median Pre	341.6	557,184	2,085,137	0.787	0.983
Median Post	298.6	470,803	1,392,461	0.606	1.066
Post/Pre Ratio					
Mean	0.940*	0.881**	0.855**	0.812***	1.095**
Median	0.921**	0.852***	0.827***	0.785***	1.111**
Proportion > 1	44.44%	19.44%	27.78%	13.89%	66.67%

Panel B:

Variable	Effective Spread (cents)	Relative Effective Spread (%)	Trade Depth (00 shares)	Trade Depth ($ 00)	Institutional Investors (%)	Institutional Investors (Number)
Mean Pre	2.117	0.73	156.78	540.53	28.48	62.06
Mean Post	2.329	0.77	165.41	507.98	30.69	64.58
Median Pre	1.886	0.49	72.97	408.04	26.69	37.50
Median Post	2.127	0.58	65.72	366.21	28.74	37
Post/Pre Ratio						
Mean	1.103***	1.157***	0.974	0.925*	1.099**	1.123***
Median	1.059***	1.174***	0.941	0.870**	1.078**	1.084***
Proportion > 1	72.22%	80.56%	36.11%	33.33%	69.70%	66.67%

Table 2.3

Multivariate analysis of changes in the bid-ask spreads of gold company stocks

Table 2.3 provides the results of the multivariate analysis of changes in the bid-ask spreads of gold company stocks. The dependent variables are Ln ES and Ln RES. The independent variables are Ln Volume, Ln Std and Ln Price. The following are the variable descriptions: Ln ES and Ln RES are the natural logarithm of effective spread and relative effective spread respectively. Ln Volume is the natural logarithm of trading volume. Ln Std is the natural logarithm of standard deviation of daily returns, calculated using the approach in Parkinson (1980). Ln Price is the natural logarithm of closing price. Dummy is a dummy variable that takes a value of 1 in the post-GLD period and 0 in the pre-GLD period. The sample period is thirty-four trading days ending ten trading days before the introduction of GLD and thirty-four trading days starting ten trading days after the introduction of GLD. For each variable, the coefficient (standard error) is reported. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

	Newey-West		Kmenta		Driscoll and Kraay	
	Ln ES	Ln RES	Ln ES	Ln RES	Ln ES	Ln RES
Intercept	-0.552***	-0.535***	-0.836***	-0.822***	-0.552***	-0.535***
	(0.110)	(0.109)	(0.063)	(0.063)	(0.130)	(0.132)
Dummy	0.060***	0.059***	0.071***	0.068***	0.060**	0.059**
	(0.015)	(0.015)	(0.012)	(0.012)	(0.026)	(0.025)
LnVolume	-0.204***	-0.204***	-0.192***	-0.191***	-0.204***	-0.204***
	(0.006)	(0.006)	(0.004)	(0.004)	(0.008)	(0.008)
Ln Std	0.345***	0.349***	0.306***	0.310***	0.345***	0.349***
	(0.018)	(0.018)	(0.009)	(0.009)	(0.020)	(0.021)
Ln Price	0.367***	-0.633***	0.351***	-0.648***	0.367***	-0.633***
	(0.009)	(0.009)	(0.004)	(0.004)	(0.009)	(0.009)
N	2438	2438	2244	2244	2438	2438

Table 2.4

Changes in spread components

Table 2.4 provides the estimates of bid-ask spread components during the pre-GLD period and the post-GLD period. It contains the means and medians of the relevant measures, their Post/Pre ratios, and the Student's *t* and signed rank test results of whether the ratios equal unity. Panel A and Panel B provide the estimates of spread components based on the Madhavan, Richardson and Romans (1997) approach and the Huang and Stoll (1996) approach respectively. The following are the variable descriptions: MRR RES is the estimated relative effective spread. ϕ and θ are the non-information and the adverse-selection components of spreads respectively. MRR RES, ϕ and θ are based on the Madhavan, Richardson and Romans (1997) approach, and are in percentage term. RRS is relative realized spread. Price impact is the difference between relative effective spread and relative realized spread. RRS and price impact are based on Huang and Stoll (1996), and are in percentage term. All other variables are as defined in Table 2.2. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

Panel A:			
Variable	MRR RES (%)	ϕ (%)	θ (%)
Mean Pre	0.40	0.16	0.09
Mean Post	0.42	0.17	0.10
Median Pre	0.32	0.13	0.05
Median Post	0.32	0.13	0.05
Post/Pre Ratio			
Mean	1.069***	1.064	1.097*
Median	1.092**	1.094	1.099*
Proportion > 1	69.44%	55.56%	66.67%

Panel B:			
Variable	RES (%)	RRS (%)	Price Impact (%)
Mean Pre	0.73	0.31	0.43
Mean Post	0.77	0.33	0.45
Median Pre	0.49	0.23	0.28
Median Post	0.58	0.22	0.33
Post/Pre Ratio			
Mean	1.157***	1.170	1.334***
Median	1.174***	1.045	1.230***
Proportion > 1	80.56%	55.56%	66.67%

Table 2.5

Changes in spreads and adverse-selection component

Table 2.5 provides the differences in spreads and adverse-selection component during the pre-GLD period and the post-GLD period between the gold companies and the matching companies. It contains the means and medians of differences in the relevant measures, their Post versus Pre differences, and the Student's *t* and signed rank test results of whether the Post versus Pre differences equal 0. All other variables are as defined in Table 2.2 and 2.4. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

Variable	ES (cents)	RES (%)	θ (%)	Price Impact (%)
Mean Diff Pre	-0.511	-0.320	-0.06	-0.15
Mean Diff Post	-0.228	-0.181	-0.02	-0.06
Median Diff Pre	-0.250	-0.047	-0.01	-0.04
Median Diff Post	0.032	0.011	0.00	0.01
Mean Diff-in-Diff	0.283*	0.139**	0.036*	0.099
Median Diff-in-Diff	0.184**	0.093***	0.007***	0.072*

Table 2.6

Multivariate analysis of changes in the bid-ask spreads of gold company stocks relative to changes in the spreads of other metal-mining companies' stocks

Table 2.6 provides the results of the multivariate analysis of changes in the bid-ask spreads of gold company stocks relative to spreads of stocks of other metal-mining firms. The dependent variables are Ln ES and Ln RES. The independent variables are Dummy, Gold, Dummy × Gold, Ln Volume, Ln Std and Ln Price. The following are the variable descriptions: Gold is a dummy variable that equals 1 if a firm is a gold company and 0 otherwise. All other variables are as defined in Table 2.3. The sample period is thirty-four trading days ending ten trading days before the introduction of GLD and thirty-four trading days starting ten trading days after the introduction of GLD. For each variable, the coefficient (standard error) is reported. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

	Newey-West		Kmenta		Driscoll and Kraay	
	Ln ES	Ln RES	Ln ES	Ln RES	Ln ES	Ln RES
Intercept	0.207**	0.218**	-0.080*	-0.075*	0.207*	0.218**
	(0.096)	(0.095)	(0.044)	(0.045)	(0.104)	(0.105)
Dummy	0.001	0.000	0.001	-0.001	0.001	0.000
	(0.026)	(0.026)	(0.016)	(0.016)	(0.026)	(0.026)
Gold	-0.181***	-0.181***	-0.196***	-0.195***	-0.181***	-0.181***
	(0.025)	(0.025)	(0.012)	(0.012)	(0.014)	(0.014)
Dummy × Gold	0.059*	0.059*	0.075***	0.074***	0.059*	0.059*
	(0.030)	(0.030)	(0.016)	(0.016)	(0.035)	(0.035)
Ln Volume	-0.233***	-0.233***	-0.220***	-0.220***	-0.233***	-0.233***
	(0.006)	(0.006)	(0.003)	(0.003)	(0.006)	(0.006)
Ln Std	0.414***	0.416***	0.374***	0.377***	0.414***	0.416***
	(0.015)	(0.015)	(0.005)	(0.005)	(0.016)	(0.016)
Ln Price	0.414***	-0.586***	0.400***	-0.600***	0.414***	-0.586***
	(0.007)	(0.007)	(0.003)	(0.003)	(0.007)	(0.007)
N	3730	3730	3536	3536	3730	3730

Table 2.7

Multivariate analysis of changes in liquidity measures and adverse-selection cost

Table 2.7 provides the results of a multivariate analysis of changes in gold companies' liquidity measures and adverse-selection cost. The dependent variables are the Post/Pre ratio of ES, RES, θ or Price Impact. The independent variables are firm size (alternatively, analyst coverage) and the correlation between the returns on each gold company stock and gold returns. I use market capitalization on August 31, 2004 to proxy for firm size, and use the average recommendation numbers from I/B/E/S between January 2004 and June 2004 to proxy for analyst coverage. Ln Size is the natural logarithm of firm size. The period used to calculate the correlations between gold company stock returns and gold returns is three months ending ten trading days before my event window. All other variables are as defined in Table 2.2 and Table 2.4. For each variable, the coefficient (White's heteroscedasticity-consistent standard error) is reported. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	Post/Pre Ratio							
	ES	ES	RES	RES	θ	θ	Price Impact	Price Impact
Intercept	0.220	0.986***	0.084	0.954***	0.343	1.278***	-1.867**	0.802**
	(0.331)	(0.243)	(0.236)	(0.175)	(0.308)	(0.175)	(0.791)	(0.352)
Ln Size	0.070***		0.084***		0.087***		0.239***	
	(0.017)		(0.021)		(0.027)		(0.068)	
Correlation	-0.046	0.025	-0.040	0.240	-0.821**	-0.661	0.128	0.152
	(0.472)	(0.491)	(0.316)	(0.366)	(0.331)	(0.398)	(0.566)	(0.714)
Analyst Coverage		0.012***		0.009***		0.012**		0.045***
		(0.004)		(0.003)		(0.005)		(0.011)
N	35	35	35	35	35	35	35	35
adj. R^2	0.228	0.173	0.395	0.135	0.162	0.069	0.391	0.397

Chapter 3 : The Securitization of Gold and Its Potential Impact on Gold Stocks' Pricing

3.1 Introduction

In this chapter, I continue my investigation of the effects the introduction of GLD on gold company stocks. As stated in the previous chapter, GLD is the first bullion-backed ETF in the U.S. market. It was introduced to the market in November 2004 and has gained great popularity after its introduction. The objective of the fund is to track the gold returns. To do so, it holds physical gold as its underlying assets.

The results in the previous chapter suggest that the introduction of GLD attracted traders, especially uninformed traders, from gold company stocks. As a result, the demand for gold stocks declined.[28] The main objective of this chapter is to study how GLD's introduction affected the pricing of gold company stocks. Furthermore, I explore the channels through which GLD may affect prices of gold company stocks. Few papers study how new financial innovations affect the pricing of existing securities. The major reason for this is that most new financial innovations are not successful enough to have noticeable impacts on existing, related securities. Due to its great success, the introduction of GLD

[28] As GLD became increasingly popular, gold companies periodically accused GLD and other gold-backed ETFs of attracting investors away from their stocks. For example, Charles Jeanne, CEO of Goldcorp, said that people simply bought the gold-backed ETFs and did not look to their business. He suggested that gold companies should take actions to compete with ETFs for investor attention. See "Goldcorp CEO Out to Transform Mining Company" (http://www.institutionalinvestor.com/Article.aspx?ArticleId=3118507&single=true#.VmXrZPmrTIU).

provides me with a unique opportunity to study the effects of new financial instruments on the pricing of existing related securities.

I find that gold company stocks significantly underperformed the benchmark after GLD started trading. On average, gold stocks experienced a negative abnormal return of –1.90% on GLD's introduction day, and a cumulative abnormal return of approximately –12% during the first month. One explanation for the decline is that the demand for gold stocks was not perfectly elastic due to lack of close substitutes (e.g., Scholes, 1972; Wurgler and Zhuravskaya, 2002). Rather, the stocks' demand curves were downward-sloping. The migration of trading activities to GLD represented negative demand shocks to the stocks, which caused their demand curves to shift inward and their prices to decline. Another possible explanation is that gold stocks became less liquid and thus were more costly to trade (i.e., due to higher bid-ask spreads, as reported in the previous chapter). Therefore, investors required higher expected returns to compensate themselves for the higher costs (e.g., Amihud and Mendelson, 1986). My further test provides support for both explanations with respect to the immediate price effects (i.e., the abnormal return on GLD's introduction day). For longer-term price effects (i.e., the cumulative abnormal return over the first month), however, the imperfect-substitutes argument is more significant and dominant.

This essay contributes to an emerging literature on the securitization of commodities (i.e., commodity investment through securities such as commodity futures contracts and commodity-linked instruments). A few papers in this literature look at the effects of commodity securitization on the prices and return dynamics of other related assets. For example, Henderson et al. (2012) find that investor flows into commodity-linked notes significantly increased commodity futures prices on the notes' issuance dates through hedging trades executed by the notes' issuers. That is, commodity-linked notes attract investors whose demand for commodity exposure gets passed through to the futures market. This chapter shows that the securitization of commodities can have a negative effect on the commodity company stocks' prices if the new securities attract investors away from the stocks.

In a wider context, the results on the price effects are related to studies on the effect of demand on asset prices. Evidence that asset prices can be affected by their demand is typically found in studies on stock inclusions into, or removals from, major stock indices. These studies find that stocks that were newly included into (removed from) a major stock index earned significant positive (negative) abnormal returns during the adjustment periods (e.g., Shliefer, 1986; Goetzmann and Garry, 1986; and Dhillon and Johnson, 1991). They interpret the results as being consistent with the hypothesis that demand curves for stocks slope down due to limits to arbitrage. For the same reason, Braun and Larrain (2009) report that new IPO securities caused the demand and prices of existing securities that were positively correlated with them to decline. Also, Garleanu et al. (2009) show that option demand can affect option prices when market makers cannot completely hedge their inventories. My results provide evidence from a different context to support these findings.

This chapter is organized as follows. In the next section, I describe the data used in this essay. In Section 3.3, I describe the background of GLD and gold investment alternatives. In Section 3.4, I compare GLD with gold company stocks in terms of liquidity and adverse selection risks. In Section 3.5, I discuss theoretical predictions on the effects of GLD on the pricing of gold stocks. Section 3.6 examines the price effects of GLD empirically. Finally, Section 3.7 concludes.

3.2 Sample Description

To study the effects of GLD on gold company stocks, I continue to use the sample firms used in chapter 2. The firms need to satisfy the following requirements. First, they were classified as belonging to the gold ores industry (SIC four-digit code: 1041) at the time of the introduction of GLD. Secondly, the companies in the sample were listed on either the New York Stock Exchange (NYSE) or the American Stock Exchange (AMEX), and were included in the CRSP database. Thirdly, I require that the stocks be traded every day in the sample period. Finally, firms that were involved in a major confounding event, such as a lawsuit, a merger/acquisition or a stock split/reverse stock split, during the sample period are excluded. The transactions data are obtained from the New York Stock Exchange's Transactions and Quotes (TAQ) database. I obtain the price data and data used to calculate abnormal returns from CRSP, while the rest data are obtained from Bloomberg.

I have in total thirty-six companies in my sample. The summary statistics are given in Table 3.1. The average market capitalization of the sample firms is \$1.4 billion. The number of trades and trading volume vary significantly among the sample firms. The statistics based on the data of November 1, 2004 show that the average number of trades of the sample firms is 695 with a standard deviation of 782.5, and the average trading volume is 768,194 shares with a standard deviation of 876,685 shares.

[Insert Table 3.1 here]

3.3 Background of GLD and Gold Investment Alternatives

The SPDR Gold Trust exchange-traded fund was introduced to the market on November 18, 2004. It is the first bullion-backed ETF in the U.S. market. Its objective is to track the gold returns. To do so, it holds physical gold as its underlying assets and issues shares that represent the ownership of the gold. The shares of the fund are traded on the New York Stock Exchange (NYSE) under the tic symbol GLD. The introduction of GLD represented a landmark decision of the SEC, because before GLD there was no physically-backed commodity ETFs in the U.S. market. Like any listed security, GLD can be traded between investors in the secondary market. As an ETF, GLD can also be created and redeemed directly with the trust in large lots (multiples of 100,000 shares) by authorized participants. This mechanism allows authorized participants to exploit the discrepancies between GLD's net asset value (NAV) and its market price, which ensures that GLD price tracks gold returns almost perfectly.

Gold is an asset with intrinsic qualities, which makes it very unique for investors. The existing literature documents several benefits of investments in gold and why investors should hold it in their portfolios. For example, gold acts as a safe haven in extreme market conditions (Baur and Lucey, 2010). Gold can be used to hedge against inflation risk (e.g., Ghosh et al., 2004), and against US Dollar fluctuations (e.g., Capie et al., 2005; Reboredo, 2013). More importantly, gold has low correlation with other assets, and therefore can be used to hedge against market risk, thus playing an important role in a diversified portfolio (e.g., Hillier et al., 2006; McCown and Zimmerman, 2006).

Investors can gain exposure to gold in several ways. To better understand them, I compare the risk and return characteristics and the diversification benefits of three gold investment alternatives. They are gold bullion, gold company stocks, and gold mutual funds. Since mutual fund data are not available before September 1998, the comparison covers the period between 1999 and 2003, the year before GLD's introduction. I use the returns of the NYSE Arca Gold BUGS Index (HUI) and the Philadelphia Gold and Silver Index (XAU) to proxy for the returns of gold stocks. These two indices are the two most watched gold indices on the market. HUI is a modified equal-dollar-weighted index of companies engaged in gold mining. As it intends to provide significant exposure to near-term movements in gold prices, companies included in it do not hedge their gold production beyond 1.5 years. XAU is a capitalization-weighted index composed of companies involved in the gold or silver mining industry.[29] Gold mutual fund daily data come from the CRSP US Survivor-Bias-Free Mutual Funds database. The funds are classified in the database as having the Lipper's objective of being "gold-oriented" funds.[30] I calculate the equally-weighted average of these funds' returns and use it as the proxy for gold mutual fund returns. Market returns are proxied by the CRSP value-weighted market index returns.

[29] Daily data of HUI, XAU and gold prices are obtained from Bloomberg.

[30] Lipper's classification system defines "gold-oriented" funds as funds investing in gold mines, gold mining finance houses, gold coins or bullion.

Table 3.2 presents basic comparisons among the three gold investment alternatives. The average daily return on the market portfolio during the sample period was only 1 basis point, which reflected the early 2000s recession. During the same period of time, gold bullion and gold mutual funds acted as a safe haven and performed better than market portfolio with average daily returns of 3 and 10 basis points respectively. Although the return of gold mutual funds was higher than that of gold bullion, the funds were also riskier than gold bullion as evidenced by their higher standard deviation. The return of gold stocks, as proxied by the two gold indices, was similar to that of gold mutual funds. However, they were much more volatile than gold mutual funds.

[Insert Table 3.2 here]

Table 3.3 shows correlation coefficients between every pair of investment alternatives. All alternatives had negative correlation with the market portfolio, which supports the diversification argument of gold investment. It is interesting to note that gold mutual funds and gold stocks were not highly correlated with gold bullion. The correlation coefficient between gold mutual fund and gold bullion was 0.69, while the correlation between HUI (XAU) and gold bullion was only 0.66 (0.62). The results reflect the fact that returns on gold stocks depend not only on gold prices but also on other firm-specific factors.

[Insert Table 3.3 here]

Finally, I test the diversification benefits of the three gold investment alternatives by estimating the following market model:

$$R_{g,t} = \alpha + \beta \times R_{m,t} \tag{3.1}$$

where $R_{g,t}$ is the return on each investment alternative, and $R_{m,t}$ is the market portfolio return. Since the error term may exhibit conditional autoregressive heteroskedasticity, I estimate equation (3.1) by using the GARCH (1, 1) model.

The regression estimates are displayed in Table 3.4. Panel A presents the estimates for gold bullion. The market beta of gold bullion is -0.114, which is significant at the level of 1%. This indicates that investment in gold bullion can hedge the market risk and thus provide diversification benefits to investors. The regression estimates for gold mutual funds in Panel B also show that the funds have a significantly negative beta and diversification benefits, although their beta (-0.066) is not as low as the beta of gold bullion. The betas of HUI and XAU are -0.199 and -0.129, both significantly negative at the level of 1% and 5% respectively. The results in Table 3.4 indicate that all gold investment alternatives have significant and quantitatively similar diversification benefits.

[Insert Table 3.4 here]

In summary, the results in this section show that although different gold investment alternatives all have diversification benefits, they exhibit different characteristics. Gold mutual funds and gold stocks are not perfect substitutes for gold bullion. Due to the firm-specific risks of gold companies, returns on gold stocks are more volatile than returns on gold bullion. As a result, if investors want to gain diversification benefits of gold and be exposed to the gold price risk only, gold bullion is a better choice than gold stocks. Due to the fact that GLD can be traded like gold stocks in the open market while it also tracks gold prices almost perfectly by holding gold bullions as its underlying asset, it should be a very competitive gold investment alternative.

3.4 Comparison between GLD and Gold Company Stocks

In this section, I compare various aspects of GLD and gold company stocks. First, I compare their trading-activity and liquidity measures during the post-GLD period. I calculate the differences in those measures on a daily basis for the 34 trading days in the post-GLD period, and test whether their mean and median are significantly different from zero based on the 34 observations. The results are reported in Table 3.5. In Panel A, I compare the number of trades and the trading volume in both shares and in dollars (see Appendix 2.1 for formal descriptions) between GLD and gold company stocks. The three measures of trading activity show that GLD gained popularity immediately after its introduction. The number of trades and trading volume in both share term and dollar term far exceed the averages for the stocks. For example, the mean daily number of trades of GLD is close to twice the average of gold company stocks (i.e., 1,241 vs. 755), while the trading volume (in dollar term) of GLD is about eleven times as high.[31]

[Insert Table 3.5 here]

[31] Note that the median values for all the measures for gold company stocks in Table 3.5 are not the same as the median values in the post-GLD period in Table 2.2. This is because in Table 3.5, I calculate the median by first averaging the values of each measure across firms within a day, and then ranking the daily values. That is, the median is calculated based on 34 daily observations. I calculate the median this way because there are also 34 daily observations for GLD, with which I want to compare. On the other hand, the median values in Table 2.2 are calculated by first averaging across days for each firm, and then ranking those individual firms.

The estimates of the liquidity measures in Panel B show that GLD is a much more liquid security than an average gold stock. Specifically, I compare the effective spread, the relative effective spread and the trade depth in both shares and dollars (see Appendix 2.1 for formal descriptions) between GLD and gold company stocks. Effective bid-ask spreads, in both dollar term and particularly percentage term, are significantly lower for GLD than for an average gold stock. This suggests that trading in GLD involves much less transaction costs than trading in gold stocks. I also find that, on average, the market of gold company stocks is shallower than that of GLD. The quoted depth (in dollar term) of gold company stocks on average is about seven times smaller than that of GLD. The quoted depth (in share term), however, is higher for gold stocks. I attribute this to the fact that GLD has a higher price than an average gold stock. The average price of GLD during the post-GLD period is around \$43, while the average price of an average gold stock during the same period is around \$8.

Next, I show that trading in GLD entails lower adverse-selection risk than trading in gold company stocks. Table 3.6 presents the comparison of spread components between GLD and gold company stocks based on the Madhavan et al. (1997) (henceforth referred to as "MRR") and the Huang and Stoll (1996) approaches. Under the MRR approach, bid-ask spreads are decomposed into a non-information component ϕ, which includes order-processing cost and inventory cost and an information component θ, which measures adverse-selection cost. Huang and Stoll (1996) decompose the spreads in a different way. They decompose the spreads into realized spread and price impact. Realized spread measures the actual post-trade revenues earned by the market maker. Price impact is defined as the difference between effective spread and realized spread. It estimates the amount that market makers lose to informed traders (i.e., adverse-selection cost). I use the data on GLD trading during the post-GLD period in the estimation. All the variables are in percentage term.

[Insert Table 3.6 here]

In Panel A, the spread components are estimated using the MRR approach. Both the non-information component (ϕ) and the adverse-selection component (θ) of GLD's spreads are significantly smaller than their gold stocks' counterparts. The results based on the Huang and Stoll approach are similar and are reported in Panel B. The mean (median) relative realized spread of GLD is much smaller than that of gold company stocks (a difference of 0.31% (0.29%)), both of which are significant at the 1% level. Similarly, the mean (median) relative price impact of GLD is significantly lower than that of gold company stocks (a difference of 0.42% (0.41%)). The magnitude of the differences in both the realized spread and price impact is significant both statistically and economically.

In summary, the results in this section indicate that the market of GLD is more liquid than that of gold company stocks on average. Traders face lower transaction costs when they trade GLD. This is especially true when it comes to the adverse selection costs. The results suggest that liquidity traders, who wanted a pure play on gold, would have great incentives to migrate to GLD after its introduction because of its liquid market, low transaction costs and low potential losses to informed traders.

3.5 Theoretical Predictions

The findings so far reinforce the results in chapter 2. Because GLD was a more attractive gold investment vehicle for traders, especially uninformed traders and traders who wanted a pure play on gold, its introduction led to a decline in demand of gold stocks. To predict the effects of this negative demand shock on prices of gold stocks, I rely on a few arguments that have been put forth in the literature.

A. The Imperfect-Substitutes Argument

In a frictionless market where assets have perfect substitutes, their prices are not affected by changes in their demand or supply (Scholes, 1972). This is because the market will price assets such that the expected returns on assets of similar risk are equal. If a change in demand or supply of an asset causes it to sell at a price that yields a different expected return, arbitrageurs can take advantage of this opportunity by buying (or selling) this asset and taking an opposite position in its substitute. As a result, demand curves for stocks are kept flat by arbitrage forces.

In actual markets, however, perfect substitutes do not exist. Therefore, the type of arbitrage transaction described above is not without risk. Wurgler and Zhuravskaya (2002) formally develop a model to show that when there is arbitrage risk, demand curves for stocks will be downward-sloping. When a demand shock occurs, the stock's demand curve will shift (inward or outward) while its supply curve remains the same.[32] As a result, the

[32] Supply of shares is fixed in the short run, and so the supply curve is vertical.

price of the stock will change. The magnitude of the change depends on the slope of the demand curve and the size of its shift. The steeper the demand curve and/or the larger the shift, the stronger the price effect is. Stocks that have steeper demand curves are those with no close substitutes, which make arbitrage more risky.

Along the same line, Greenwood (2005) shows that the price effect is proportional to the contribution of the demand shock to the risk of the arbitrage portfolio. When demand shocks occur simultaneously to a group of stocks, the price effect is stronger if the stocks in the group co-move with one another (and thus cannot be used as a hedge against each other to reduce the risk of the arbitrage portfolio).

In the literature, this line of reasoning is typically referred to as the imperfect-substitutes argument. The argument implies that the price effect will be permanent as the new price reflects a new equilibrium distribution of security holders (Harris and Gurel, 1986). Adapted to my context, the introduction of GLD could attract traders away from gold company stocks, causing a negative demand shock. Prices of these stocks would decline, and the decline would be permanent. In addition, since GLD affected *all* gold stocks, arbitrage risk was higher and the price effect should, on average, be strong.

B. The Price-Pressure Argument

The price-pressure argument states that demand shocks are absorbed by traders who agree to immediately buy or sell securities that they normally would not trade (Scholes, 1972). Therefore, even if the fundamental value of the stock does not change, its price has to decline (increase) when there is a large sale (purchase) in order to attract these traders.

Then shortly afterwards, the price will revert to its fundamental level. The initial price change and the subsequent reversal compensate these traders for the service that they provide and the risk that they bear.

A similar argument is made in Campbell et al. (1993), who show that risk-averse utility-maximizing traders will be willing to accommodate the fluctuations in demand for stock from liquidity or non-informational traders only if they are rewarded for it. As in Scholes (1972), the reward demanded by traders who accommodate the selling pressure is in the form of a lower transaction price. The reward is realized when the price of the stock returns to its fundamental value.

Accordingly, applied to my context, the price pressure argument predicts that prices of gold company stocks would decline after the introduction of GLD, but the decline would be temporary.

C. The Liquidity-Premium Argument

Amihud and Mendelson (1986) show that the expected return on a stock is an increasing function of its relative (i.e., percentage) bid-ask spreads. This positive relationship reflects the fact that investors require compensation for transaction costs. The relationship implies that if there is a change in the relative bid-ask spreads of a stock, the stock's expected return will change. It follows that its price will change, and the change will be permanent. In my context, I report in chapter 2 that the relative spreads of gold company stocks increased significantly after the introduction of GLD. As a result, the liquidity-premium argument suggests that the stocks' expected returns should increase and their prices should decline in the post-GLD period.

D. Summary of Arguments

All of the above arguments predict that the prices of gold company stocks should decline after the introduction of GLD. One important difference among them is that the decline will be permanent under the imperfect-substitutes and the liquidity-premium arguments, but will be temporary under the price-pressure argument.

A number of prior studies have empirically tested the imperfect-substitutes argument and the price-pressure argument, particularly in the context of stock inclusions into, or removals from, major stock indices. Most of these studies concentrate on inclusions (which raise the demand for the included stocks), and ignore removals (which reduce the demand for the removed stocks, and which are closer in spirit to my study). For studies that examine removals, their results are not entirely conclusive. For example, Harris and Gurel (1986) and Chen et al. (2004) study stock removals from the S&P 500 index, and report significant price drops around the removal dates which subsequently were almost completely reversed (i.e., cumulative abnormal returns becoming insignificantly different from zero) after 11 and 20 trading days respectively. Since the price effects were temporary, these results appeared to support the price-pressure hypothesis rather than the imperfect-substitutes hypothesis. On the other hand, Lynch and Mendenhall (1997) study the same index, but report that the price reversal was only partial, and conclude that their results support both hypotheses.

Madura and Ngo (2008) examine the price effects of ETFs on their component stocks. They find that the price effects were positive and significant, especially for large ETFs. I interpret their results as being consistent with positive demand shocks to the component stocks as these ETFs have to hold those stocks. Madura and Ngo do not, however, examine whether the price effects were subsequently reversed.

As for the liquidity-premium argument, the positive relationship between expected returns and bid-ask spreads has been empirically verified in several studies including Amihud and Mendelson (1991), Datar et al. (1998) and Hasbrouck (2009).

3.6 Empirical Results

3.6.1 Price Effects of GLD

To measure the price effects of GLD on gold company stocks, I estimate the stocks' abnormal returns (ARs) and cumulative abnormal returns (CARs) during the period surrounding GLD's introduction day. Since all the firms in my sample come from the same industry and I want to examine the effects of a common event on them, it is likely that their returns will be cross-sectionally correlated. As a result, the traditional event-study methodology introduced by Fama et al. (1969) is not appropriate. Instead, I will use the event-parameter approach discussed in, for example, Schipper and Thompson (1983) and Binder (1985), and commonly used in studies that examine the impact of common events, such as regulatory changes, across firms (e.g., Karpoff and Malatesta, 1995; Akhigbe and Martin, 2006; Doidge et al, 2010). The approach involves constructing an equally-weighted portfolio of the stocks under investigation, and regressing the portfolio's returns on a constant, event indicator variables and benchmark return-generating factors.

My benchmark return-generating factors are the four factors in Carhart's (1997) model, which are the three factors in Fama and French's (1993) model (i.e., market risk, size, and book-to-market) plus the momentum factor. In addition, following Tufano (1998), I include gold returns as a factor in order to capture the impact of gold price movements on gold stock returns.[33] To account for the possibility of non-synchronous trading, I use the Dimson (1979) approach and include one lagged and one leading terms for the market risk factor and gold returns. Accordingly, the regression equation is:

$$R_{p,t} = \alpha + \sum_{j=-1}^{+1} \beta_j^M R_{m,t+j} + \gamma_1 \times SMB_t + \gamma_2 \times HML_t + \gamma_3 \times UMD_t + \sum_{j=-1}^{+1} \beta_j^G R_{g,t+j} + \sum_{i=-10}^{22} \lambda_i D_i, \qquad (3.2)$$

where

$R_{p,t}$ = return on day t on the equally-weighted portfolio of gold company stocks;

$R_{m,t}$ = market return on day t, as proxied by CRSP value-weighted market index;

SMB_t = return differential between the average small-cap and the average large-cap portfolios on day t;

HML_t = return differential between the average value and the average growth portfolios on day t;

UMD_t = return differential between the highest and the lowest prior-return portfolios on day t;

$R_{g,t}$ = gold return on day t; and

[33] As reported in Table 2.1, returns on gold stocks are positively correlated with gold returns (average correlation = 0.52).

D_i = a dummy variable set to be one if day i = day t, and zero otherwise.

The estimated coefficient for each dummy variable, λ_i, measures the abnormal return on the portfolio on day i. The summed value of λ_i's over a certain interval is therefore the cumulative abnormal return on the portfolio over that interval. I estimate λ_i for each day during the period from ten trading days (i.e., two weeks) before GLD's introduction to twenty-two trading days (i.e., one month) after. This period is intended to account for the possibility that traders may have anticipated the issuance of GLD and so started to sell their holdings of gold stocks before GLD's introduction day.[34] The period also accounts for the possibility that the migration from gold stocks to GLD could be gradual, and so the effects on gold stock prices may have lasted longer than a few days after GLD's introduction. In addition, the period allows us to observe whether a reversal of the price effects would occur within that time.

The above regression is run using daily observations over the period of six months centering on the GLD's introduction day. As Tufano (1998) shows, the sensitivity of gold stocks to market returns and gold returns (i.e., the stocks' market betas and gold betas) varies across time (and even from quarter to quarter). Therefore, it is not appropriate to use a long period in the estimation, as betas can change over that period.

[34] GLD went through a long (18 months) approval process at the US Securities and Exchange Commission (SEC). It was only about a week or two before GLD's introduction day that reports started to appear that the approval was imminent. See "SEC Close to Backing New Gold Product" in the November 8, 2004 edition of the *Financial Times* newspaper).

The estimated CARs of the portfolio are presented in Table 3.7 and Figure 3.1. In Figure 3.1, I plot the portfolio's CARs from day -10 to day +22 relative to the listing date of GLD (i.e., day 0). A casual glance at the plot suggests that the prices of gold stocks were relatively stable during the ten trading days before the introduction of GLD (i.e., the CAR appeared to be close to zero). After the introduction of GLD, the CAR became negative and increasingly so for two weeks (i.e., ten trading days), before bouncing back slightly thereafter.

[Insert Figure 3.1 here]

In Table 3.7, the estimation results show that during the two weeks preceding GLD's introduction, the cumulative abnormal return, CAR (-10, -1), is 0.9%, which is not significantly different from zero. On the introduction day of GLD (i.e., day 0), the portfolio of gold stocks experienced a negative abnormal return of -1.90% (i.e., the estimated coefficient of the dummy variable D_0), which is significantly different from zero. This supports the conjecture that traders started to migrate from gold stocks to GLD immediately after GLD became available. Then, over the following two weeks, the CAR became increasingly negative, with CAR (0, 10) of -12.5%. It thus appears that the migration continued to occur during this period. Finally, in the subsequent two weeks, the CAR became stable, with CAR (0, 22) of -12.3%. This result indicates that the migration activity may already be over during this period.

[Insert Table 3.7 here]

In summary, the introduction and trading of GLD were associated with a serious adverse effect on gold company stocks. The stocks significantly underperformed the benchmark on GLD's listing date. The underperformance became more severe during the following two weeks. After two weeks, however, there did not appear to be any further significant negative effect.[35]

3.6.2 Analysis of the Price Effects

The observed decline in the prices of gold stocks in the days (and weeks) after GLD was introduced is consistent with the imperfect-substitutes argument and the liquidity-premium argument. It does not, however, lend support to the price-pressure argument because there was no significant price reversal, even after a period of a month.[36] In this section, I attempt to confirm the imperfect-substitutes and/or the liquidity-premium arguments as the source of the price effects. To do so, I run a (cross-sectional) regression of firm-level abnormal returns on several variables that are related to the two arguments.

I use two measures of firm-level abnormal returns (i.e., the dependent variable of the cross-sectional regression). They are (i) the stocks' abnormal returns on the day of GLD's introduction (AR (0)); and (ii) the stocks' cumulative abnormal returns over the one-

[35] The negative abnormal returns on the portfolio are not due to some outliers or small companies in the sample. Over the same period (i.e., from day 0 to day 22), the HUI Gold index, which is a modified equally-weighted index of approximately fifteen large gold companies that do not hedge their long-term production (roughly similar to the top half of the companies in our sample), declined by 9.67% while gold price remained approximately the same and the market (as proxied by the CRSP value-weighted market index) increased by 2.44%. That is, the negative abnormal returns occurred across the board.

[36] It is impossible to rule out completely the price-pressure argument. This is because there is no theoretical guidance regarding when price reversals should occur. Prior tests of the price-pressure argument commonly limit their observations to one month after the event day. The risk of using a longer observation period is that there may be confounding events that subsequently occur.

month period from GLD's introduction (CAR (0, 22)). These two measures allow me to investigate the factors that can explain immediate and longer-term price effects respectively. For each stock, the two measures are estimated using the regression in equation (3.2) at the company level over the same estimation period as in the previous section.

To test for the effect of the imperfect-substitutes argument, I use, as independent variables of the cross-sectional regression, two variables that are predicted to determine the size of the price effects. The first variable is the stocks' arbitrage risk (which determines the slopes of the demand curves), while the second variable is the size of the demand shocks. The stocks' arbitrage risk is calculated using the approach in Wurgler and Zhuravskaya (2002). Under this approach, the arbitrage risk of a stock depends on whether or not the stock has a close substitute, and can be measured by the variance of a zero-net-investment portfolio which holds \$1 long (short) in the stock and \$1 short (long) in a portfolio of substitutes. Wurgler and Zhuravskaya consider two potential substitutes. One is the market portfolio, and the other is a portfolio of three stocks that match the subject stock on industry and as closely as possible on size and book-to-market ratios. Their results indicate that the two substitutes yield similar and highly correlated (about 0.98) measures of arbitrage risk. Due to the fact that the introduction of GLD affected all firms in my sample at the same time, I cannot use a portfolio matched on industry as a substitute. Accordingly, I use the market portfolio as a substitute for all gold company stocks in the calculation of their arbitrage risk measures (ARMs).[37] As for the size of the demand shocks, I use the Post/Pre

[37] Specifically, to get each stock's ARM, I first regress the stock's daily excess returns on the daily CRSP value-weighted market index excess returns over the 3-month period ending 10 trading days before the GLD

ratio[38] of the sell-vs-buy volume ratio (as defined in Appendix 2.1). A larger Post/Pre ratio of sell-vs-buy volume ratio indicates a larger seller-initiated transaction proportion in the post-GLD period relative to the pre-GLD period (i.e., a greater negative demand shock). If the imperfect-substitutes argument can explain the observed price effects, the coefficients of the arbitrage risk and the size of the demand shocks should be negative and significant.

The liquidity-premium argument suggests that the price of a stock will decline (increase) if its liquidity decreases (increases). To test for the effect of this argument, I use two proxies for liquidity as the independent variables of the cross-sectional regression. The first proxy is the Post/Pre ratio of relative effective spread, while the second proxy is the Post/Pre ratio of the MRR adverse-selection cost (i.e., θ). Since these two proxies are highly correlated, only one of them will appear in the regression at a time. If the liquidity argument can explain the observed price effects, the coefficient of each proxy should be negative and significant.

I run four versions of the regression. The coefficient estimates, together with their White's heteroscedasticity-consistent standard errors are presented in Table 3.8. Columns (1) and (2) contain the results where the abnormal return on GLD's introduction day (i.e., AR (0)) is the dependent variable. In column (1), the independent variables are ARM, the Post/Pre ratio of sell-vs-buy volume ratio, and the Post/Pre ratio of relative effective spread,

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introduction day. I then define ARM as the standard deviation of the residuals from the regression. Note that for this calculation, one company was dropped from the sample because of incomplete data over the period.

[38] Post/Pre ratio for each variable is defined as $\text{Post/Pre Ratio}_i = \frac{\overline{X}_{i,post}}{\overline{X}_{i,pre}}$, where $X_{i,pre}$ and $X_{i,post}$ are the variable of interest for stock *i* in pre-GLD and post-GLD periods respectively.

while in column (2), the the Post/Pre ratio of θ is used as the proxy for liquidity instead of the Post/Pre ratio of relative effective spread. In column (1), all the independent variables are significantly negatively related to abnormal returns of gold stocks. In column (2), the coefficient of ARM is not significant but the Post/Pre ratio of sell-vs-buy volume ratio is still significant. The Post/Pre ratio of θ is also significant. These results suggest that the abnormal returns on gold stocks on GLD's introduction day (i.e., AR(0)) can be explained by both the imperfect-substitutes argument and the liquidity-premium argument.

[Insert Table 3.8 here]

Columns (3) and (4) contain the results where CAR (0, 22) is the dependent variable. In column (3), the proxy for liquidity is the Post/Pre ratio of relative effective spread, while in column (4), the proxy for liquidity is the Post/Pre ratio of θ. For both regressions, only the Post/Pre ratio of sell-vs-buy volume ratio is significant. This indicates that the longer-term price effects are associated with the negative shock to the demand of gold stocks, and not with the changes in the stocks' liquidity costs. This is not unexpected because the magnitude of the stock's longer-term cumulative abnormal returns (i.e., CAR (0, 22)) is large compared to the magnitude of the changes in the liquidity costs. As a result, the effect of the negative demand shock dominates the effect of the changes in liquidity costs in explaining longer-term cumulative abnormal returns.

In summary, the results in columns (1) and (2) show that the negative abnormal returns on gold company stocks on GLD's listing date are associated with both the decline in liquidity and the negative demand shocks. The results provide support for both the imperfect-substitutes argument and the liquidity-premium argument as the causes for the observed immediate price effects. For longer-term price effects, however, the results in columns (3) and (4) indicate that the imperfect-substitutes argument is more significant and dominant.

3.7 Conclusions

In this chapter, I study how the introduction of SPDR Gold Trust exchange-traded fund (Tic: GLD), the first bullion-backed exchange-traded fund in the U.S. market, affected the pricing of gold company stocks. I find that gold company stocks significantly underperformed the benchmark after GLD started trading. On average, the stocks' abnormal returns were about –12% during the first month. The findings are consistent with the argument that the stocks' demand curves are downward-sloping. The migration of trading activities to GLD represented negative demand shocks to the stocks, which caused their demand curves to shift inward and prices to decline. The findings are also consistent with the argument that as gold stocks became less liquid and thus were more costly to trade (due to higher bid-ask spreads), investors required higher expected returns to compensate themselves for the higher costs. A further test provides support for both explanations, but especially the former.

My results contribute to the recently emerging literature on the securitization of commodities. So far, there are a few studies in this literature that look at the effects of the securitization on the prices and return dynamics of other related assets. My findings show that the securitization of commodities can have a negative effect on the prices of commodity company stocks because of its negative impacts on commodity company stocks' liquidity and demand. My results also provide supporting evidence to the hypothesis that demand curves for stocks slope down and thus changes in demand can affect asset prices.

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Table 3.1

Summary statistics

Table 3.1 provides summary statistics for sample firms. It contains the means, standard deviations, maximums, 75th percentiles, medians, 25th percentiles and minimums of the firm characteristics for sample firms. The following are firm characteristic descriptions. Market Cap is the product of the stock's closing price and number of shares outstanding. Number of Trades is the total number of trades between 9:30 A.M. and 4:00 P.M. of the day. Trading Volume is the total number of trading volume between 9:30 A.M. and 4:00 P.M. of the day. Statistics of Market Cap, Price, Number of Trades and Trading Volume are based on data as of November 1, 2004.

Variable	Mean	Std	Max	P75	Median	P25	Min
Market Cap ($ 000s)	1,409,895	2,478,716	11,628,214	1,424,578	653,888	127,598	51,748
Price ($)	8.228	9.649	36.810	12.775	3.755	1.575	0.690
Num of Trades	694.9	782.5	3059.0	1237.5	288.0	97.5	5.0
Trading Volume (shares)	768,194	876,685	3,543,200	1,060,800	450,850	175,950	2,900

Table 3.2

Comparisons between different gold investment alternatives

Table 3.2 provides comparisons of daily returns between different gold investments. It contains the means, standard deviations, maximums, 75th percentiles, medians, 25th percentiles and minimums of returns. The comparison covers the period between 1999 and 2003

Variable	Mean	Std	Max	P75	Median	P25	Min
Market Portfolio	0.000	0.013	0.053	0.008	0.000	-0.008	-0.066
Gold Bullion	0.000	0.010	0.093	0.005	0.000	-0.004	-0.035
Gold Mutual Funds	0.001	0.018	0.150	0.010	0.001	-0.009	-0.091
HUI	0.001	0.029	0.247	0.016	-0.001	-0.016	-0.126
XAU	0.001	0.026	0.211	0.015	0.000	-0.016	-0.128

Table 3.3

Correlation between different gold investment alternatives

Table 3.3 provides correlations of daily returns between different gold investments. The period used to calculate the correlations is between 1999 and 2003.

	Market Portfolio	Gold Bullion	Gold Mutual Funds	HUI	XAU
Market Portfolio	1	-0.149	-0.049	-0.085	-0.052
Gold Bullion		1	0.692	0.655	0.621
Gold Mutual Funds			1	0.903	0.914
HUI				1	0.924
XAU					1

Table 3.4

Diversification tests

Table 3.4 provides results for diversification tests of gold investment alternatives. GARCH (1, 1) models are applied. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively. The tests are based on a period between 1999 and 2003.

	Coeff. est	Std. err.	T-stat
Panel A: Gold Bullion			
Intercept	0.000	0.000	0.22
Beta	-0.114***	0.014	-8.08
Panel B: Gold Mutual Funds			
Intercept	0.001*	0.000	1.80
Beta	-0.066**	0.035	-1.89
Panel C: HUI			
Intercept	-0.001	0.001	1.43
Beta	-0.199***	0.055	-3.6
Panel D: XAU			
Intercept	0.001	0.001	1.33
Beta	-0.129**	0.052	-2.48

Table 3.5

Comparison of trading-activity and liquidity measures between GLD and gold company stocks

Table 3.5 provides the results of the comparison of the trading-activity and liquidity measures between GLD and gold company stocks. The sample period is thirty-four trading days, starting ten trading days after the introduction of GLD. Effective Spread is defined as twice the absolute difference between the trade price and mid-point of the bid-ask quotes at the time of the trade; Relative Effective Spread is effective spread expressed as a percentage of the mid-point of the quotes. For each day, I volume-weight effective spreads and relative effective spreads, where the weights are the number of shares in each trade during the day. Trade Depth (in shares) and Trade Depth (in dollars) are the equally weighted average daily depths in share term and dollar term respectively. Dif is the difference in the daily value of the measures between GLD and gold company stocks. All variables are as defined in Table 3.1. Student's t and signed rank test results of whether Dif equals zero are also provided. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

Panel A:

Variable		GLD	Stock	Dif
Number of Trades	Mean	1,240.6	755.0	485.6***
	Median	1,013.5	719.1	320.5***
Trading Volume (shares)	Mean	2,121,979	792,158	1,329,821***
	Median	1,818,950	727,404	996,938**
Trading Volume ($)	Mean	92,253,022	8,695,316	83,557,706***
	Median	78,848,571	8,383,350	69,432,182**

Panel B:

Variable		GLD	Stock	Dif
Effective Spread (cents)	Mean	2.120	2.330	-0.209**
	Median	2.090	2.240	-0.176**
Relative Effective Spread (%)	Mean	0.05	0.76	-0.72***
	Median	0.05	0.73	-0.69***
Trade Depth (00 shares)	Mean	77.96	165.41	-87.44***
	Median	73.98	164.55	-85.23***
Trade Depth ($ 00)	Mean	3,391.70	507.98	2,883.71***
	Median	3,183.00	519.74	2,692.14***

Table 3.6

Comparison of spread components between GLD and gold company stocks

Table 3.6 provides the results of comparison of spread components between GLD and gold company stocks. The sample period is thirty-four days starting ten trading days after the introduction of GLD. Panel A and Panel B provide the estimates of spread components based on the Madhavan, Richardson and Romans (1997) approach and the Huang and Stoll (1996) approach respectively. The following are the variable descriptions: MRR RES is the estimated relative effective spread. ϕ and θ are the non-information and the adverse-selection components of spreads respectively. MRR RES, ϕ and θ are based on the Madhavan, Richardson and Romans (1997) approach, and are in percentage term. RRS is relative realized spread. Price impact is the difference between relative effective spread and relative realized spread. RRS and price impact are based on Huang and Stoll (1996), and are in percentage term. Dif is defined as the difference in the values of the variables between GLD and gold company stocks. Student's t and signed rank test results of whether Dif equals zero are also provided. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

Panel A:

Variable		GLD	Stock	Dif
ϕ (%)	Mean	0.01	0.10	-0.09***
	Median		0.05	-0.05***
θ (%)	Mean	0.01	0.17	-0.16***
	Median		0.13	-0.12***

Panel B:

Variable		GLD	Stock	Dif
RRS (%)	Mean	0.02	0.33	-0.31***
	Median	0.02	0.31	-0.29***
Price Impact (%)	Mean	0.03	0.45	-0.42***
	Median	0.03	0.46	-0.41***

Table 3.7

Cumulative abnormal returns

Table 3.7 reports the regression results of equation (3.2) and cumulative abnormal returns computed based on the results. CAR (T_1 , T_2) denotes the cumulative abnormal return from day T_1 to day T_2 relative to the GLD introduction day (day 0). It is the sum of the values of corresponding dummy variable coefficients obtained from the regression's results. For the regression, *t*-test results are reported and standard deviations of the coefficients are in parentheses. For the CAR test, *F*-test results are reported and *F*-value is in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

Abnormal Return Regression		CAR Test	
Intercept	0.000	Sums of λ_i	
	(0.001)		
		CAR (-10,-1)	0.009
Contemporaneous Market Return	0.540**		(0.06)
	(0.241)		
		CAR (0,10)	-0.125***
Lagged Market Return	-0.384**		(10.83)
	(0.190)		
		CAR (0, 22)	-0.123**
Leading Market Return	-0.007		(4.50)
	(0.181)		
Contemporaneous Gold Return	1.771***		
	(0.149)		
Lagged Gold Return	0.050		
	(0.152)		
Leading Gold Return	0.295*		
	(0.155)		
SMB	0.055		
	(0.343)		
HML	0.496		
	(0.518)		
UMD	0.679*		
	(0.354)		
D_0	-0.019*		
	(0.011)		
D_i $(i \neq 0)$	Yes		
N	125		
adj. R^2	0.695		

Table 3.8

Multivariate analysis of abnormal returns

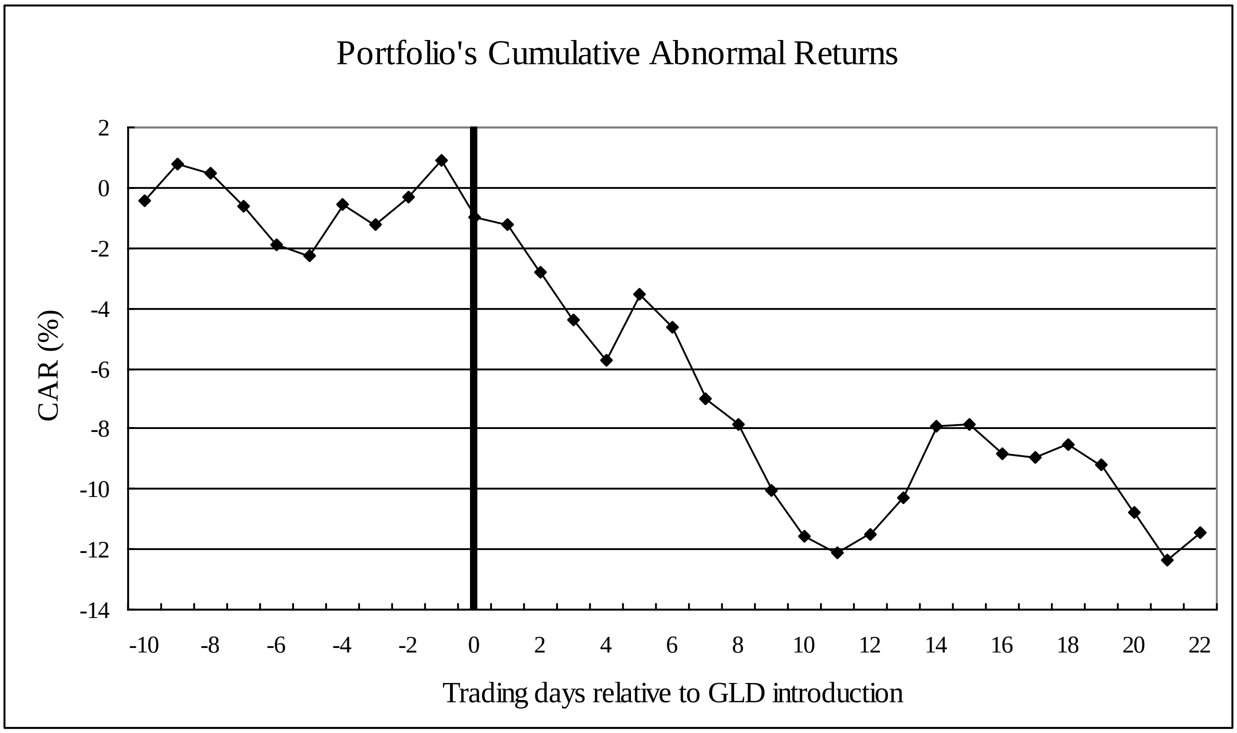
Table 3.8 provides the results of a multivariate analysis of gold company stocks' abnormal returns. The dependent variables are the stocks' abnormal returns on the introduction day of GLD (AR (0)) and the one-month cumulative abnormal returns since GLD's introduction, (CAR (0, 22)). The independent variables are the arbitrage risk measure (ARM), and the Post/Pre ratios of sell-vs-buy volume ratio, RES and θ . To estimate ARM, I first regress the daily excess returns of the gold company stock on the daily market excess returns over a 3-month period ending 10 trading days before the GLD introduction date. ARM is defined as the standard deviation of the residuals from the regression. All other variables are as defined in Table 3.6 and Appendix 2.1. For each variable, the coefficient (White's heteroscedasticity-consistent standard error) is reported. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1) AR (0)	(2) AR(0)	(3) CAR (0,22)	(4) CAR (0,22)
Intercept	0.130***	0.093***	-0.064	0.090
	(0.026)	(0.027)	(0.140)	(0.091)
ARM	-0.715*	-0.263	0.403	-0.284
	(0.373)	(0.403)	(1.881)	(1.656)
Post/Pre Ratio (sell-vs-buy volume ratio)	-0.029*	-0.049***	-0.123**	-0.123**
	(0.017)	(0.016)	(0.056)	(0.052)
Post/Pre (RES)	-0.082***		0.055	
	(0.020)		(0.078)	
Post/Pre (θ)		-0.047***		-0.066
		(0.017)		(0.069)
N	35	35	35	35
adj. R^2	0.371	0.288	0.066	0.094

Figure 3.1

Cumulative abnormal returns of portfolio of gold stocks

Figure 3.1 plots the CAR of the portfolio of gold stocks; i.e., CAR (-10, T_2) for T_2 = -10 to T_2 = +22. The CARs are computed based on regression results of equation (3.2).



Chapter 4 : Bankruptcy and the (Hidden) Cost of Organized Labor: Evidence from Union Election

With Murillo Campello, Janet Gao and Jiaping Qiu

4.1 Introduction

Despite their declining prominence, labor unions still shape human capital participation in corporate activity. Over eight million private-sector workers in the U.S. today are represented by unions and of the largest 100 industrial firms, 33 have a unionized labor force, with most of their unions formed in the last 20 years. Studies find that unionized workers receive more generous contracts and observe less pay inequality due to collective bargaining (Parsley, 1980; Western and Rosenfeld, 2011). Yet, it is hard to assess the ultimate effects of organized labor on workers and firms. Lee and Mas (2012) document that firm market values decline slowly over time following unionization. Their results are puzzling in that they cannot be explained by fundamental changes in employment, productivity, or business survival rates, as none of these variables seem to be affected by unionization (see, e.g., DiNardo and Lee, 2004).

Unionization is commonly thought of as a means to increase workers' bargaining power in negotiating contracts governing benefits such as wages, health care, and pension funding. Arguably, however, these pecuniary benefits are less important than concerns such as career development and job security. Those non-contractual interests are most endangered when firms default on their obligations, as courts are unable to explicitly assess and protect individuals' human capital investment. The U.S. Bankruptcy Code, for example, is designed to only formally safeguard workers' accumulated wages and benefits for work already performed. To protect their members' interests in bankruptcy, unions must become active parties in legal proceedings under Chapter 11. Not surprisingly, their overriding goal in those proceedings has been that of securing job preservation (see Haggard, 1983; Stone, 1988).

Unions are able to protect its members' interests in several ways during bankruptcy and this chapter shows that worker unionization has negative value implications for other corporate stakeholders. As recognized "unsecured corporate creditors," unions are eligible to gain seats in creditors' committees.[39] Section 1102(a) of the Bankruptcy Code charges the United States Trustee with the duty of organizing a committee including the largest unsecured creditors.[40] The committee has powers to: (1) investigate the debtor for fraud or incompetence, (2) participate in the formulation of reorganization plans, (3) request the replacement of managers, and (4) ask the court to dismiss the case or convert it into Chapter 7 liquidation. Debtors are legally obliged to disclose all information requested by the creditors' committee and pay - from estate assets - for all of the committee's expenses. Workers in non-unionized firms, in contrast, are not eligible to positions in creditors'

[39] Unions' claims against companies include (1) withheld union dues, (2) unpaid contributions to union pension and welfare plans, (3) unpaid wages and accrued benefits to union workers, and (4) damages following from the rejection of collective bargaining agreements (see Haggard and Pulliam, 1987). Firms in financial distress often accumulate debts on all those accounts.

[40] Dawson (2014) reports that a union was a member of the court-appointed unsecured creditors' committee in over one third of the bankruptcy cases in which the debtor was unionized.

committees. Instead, they are treated as individuals by the courts, benefitting only from limited statutory priorities. [41]

Beyond receiving special legal recognition under Chapter 11, unions resort to several additional tactics to empower workers in bankruptcy. They often organize strikes, boycotts, or public denouncements. As firms face financial difficulties, managers are more likely to work with unions to avoid disruptions that invite greater creditor control or liquidation (see Atanassov and Kim, 2009). When convenient, unions use their leverage in court so that bankruptcy proceedings allow for disruption of absolute priority rules (APR), whereby unsecured creditors' claims lose seniority.[42] Unions can also make bankruptcies last longer than necessary, using the courts to force parties into repeated, costly negotiations over workers' demands. In securing continued employment for their workers, unions can also facilitate inefficient reorganizations in lieu of liquidation. This is an important issue since firms that emerge from reorganization often re-enter bankruptcy, as unions resist asset sales and worker layoffs. Even in cases where firm ownership is transferred, the successor is legally bound to negotiate and bargain with the predecessor's labor union.

We study the effect of unionization on unsecured corporate creditors by examining the price reaction of publicly-traded bonds to labor union elections. We do so using election data from the National Labor Relations Board (NLRB). Union elections in the U.S. are

[41] Employee benefit and wages priority privileges are currently capped at only $10,000 per worker.
[42] In the Chrysler bankruptcy case, United Auto Workers (UAW) was instrumental in having the reorganized entity (“new Chrysler”) assume $4.5 billion of employee benefits from “old Chrysler.” The company distributed 55% of its equity to satisfy $10 billion of obligations to labor unions. Most other creditors, by comparison, recovered less than 30 cents per dollar from asset sales, despite having more senior claims (Adler, 2010).

conducted through secret ballot voting, sometimes with little advance notice. Once a union wins over 50% of the votes, the union attains legal recognition and its members can exercise collective bargaining over compensation, benefits, and disputes with management and investors. These rights are governed and protected by the National Labor Relations Act (NLRA) and a successful union election can discretely increase the bargaining power of workers in a firm.

We combine the NLRB union vote data with information on publicly-traded bonds from TRACE, Mergent FISD, and the University of Houston Database. Publicly-traded bond prices represent a unique value metric with which to gauge the effects of unionization on the expected costs of corporate default. Unlike other creditors (e.g., banks and syndicated lenders), it is very difficult for investors of diffusely-held bonds to renegotiate their claims with borrowers. Bond investors, instead, dispose of their securities in the market in response to innovations to the value of their claims. Given the concave structure of bond payoffs (capped at issue face values in non-bankruptcy states), bond prices reflect investors' expected payments in bankruptcy states. Innovations that increase expected bankruptcy costs lead to declines in the secondary market price of corporate bonds. As holders of unsecured, senior claims, bondholders' interests are particularly sensitive to any deviations from an orderly bankruptcy process.

Naturally, both the occurrence and the results of union elections are related to firm-specific conditions, rendering it challenging to identify the causal impact of unionization on bond prices. To wit, the average union-win firm might differ from the average union-loss counterpart in several dimensions (both observable and unobservable). To establish causality in our tests, we resort to a regression discontinuity design (RDD) that utilizes local variations in the vote share of workplace elections that lead to discrete changes in union legal status. In short, our tests contrast bond price reactions to closely-won union elections with bond price reactions to closely-lost elections. Close winners gain representation status while close losers do not, yet average firm characteristics and workers' support for unions are ex-ante similar across the two groups of firms. Given the nature of secret ballot elections, it is unlikely for individuals or firms to precisely anticipate or manipulate the outcome of union elections. Under these regularity conditions (which we verify in the data), differences in bond price reactions to close election outcomes can be plausibly attributed to the causal effect of unionization.

Our results show that unionization negatively affects the wealth of senior, unsecured corporate creditors. It does so in an economically significant manner. A simple event study shows that closely-won union elections are associated with a negative 60 (180)-basis-point average cumulative abnormal return (CAR) over the 3-month (12-month) window following election events, while closely-lost elections are associated with a statistically insignificant negative 10 (60)-basis-point CAR over the same window. Results from RDD analyses show even larger effects. Closely-won union elections lead to a 200 (500) basis points greater decline in bond CARs than closely-lost elections during the 3-month (12-month) post-election window.[43]

[43] The horizons we consider follow prior literature on the effects of unionization (e.g., DiNardo and Lee, 2004; Lee and Mas, 2012) and event studies on bond returns (e.g., Warga and Welch, 1993; Eberhart and Siddique, 2002; Ellul et al., 2011).

We also investigate the mechanisms through which unionization reduces bond values. From a pricing perspective, the decline in bond values could be associated with increases in (1) default probabilities or (2) in-court bankruptcy costs (or both). We first examine whether unionization increases default risk by tracking firms' business performance following unionization. Contrasting the performance of close union winners and losers, we find no evidence that close union winners perform worse or become more likely to go bankrupt than close losers for several years after the vote. At the same time, bond CARs of close union winners show noticeable declines even when their remaining time to maturity is relatively short (less than five years). Our results imply that the negative impact of unionization on bond prices is unlikely to be caused by increases in default probability.

We next examine the effects of unionization on in-court bankruptcy costs. We use information from the UCLA-LoPucki bankruptcy database to compute court cost measures including the duration of bankruptcy proceedings, the fees paid to financial and legal professionals, and creditors' committee expenses. We find that bankrupt firms with unionized workers experience more prolonged bankruptcy proceedings and are also more likely to go through inefficient reorganizations, as evidenced by a higher likelihood of emergence from bankruptcy and refiling for bankruptcy thereafter. Unionized firms are also more likely to reorganize under debtor-in-possession (DIP) financing.[44] We also find that firms with labor unions incur significantly higher expenses and fees in bankruptcy court,

[44] These financing arrangements often force pre-existing senior creditors into more junior claimant categories; yet they allow firms to continue operating and workers to keep their employment.

including fees paid to attorneys and creditors' committees. Notably, these costs increase with the number of seats assigned to unions in unsecured creditors' committees. Taken together, the results are consistent with the notion that unionization significantly increases firms' bankruptcy costs, with those costs being ultimately imposed onto other financial stakeholders of the firm.

We exploit firm heterogeneity to verify that unionization affects bond values through in-court bankruptcy costs. We do so by comparing subsamples of financially-distressed and financially-healthy firms. One would expect the bond prices of distressed firms to have more negative reactions to unionization, as these firms are closer to realizing increased in-court bankruptcy costs associated with unionization. We consider several measures of financial distress in our analysis, including Altman's Z-score, Ohlson's O-score, Merton's distance to default, as well as Moody's credit ratings. These distress measures are similarly distributed across firms where union elections are closely won and lost. Yet, consistently across all measures, RDD results show that unionization has a much greater impact on the bond values of distressed firms.

Finally, we examine the argument that the value impact of unions can be ascribed to increases in the bargaining power of the workers they represent. To do so, we experiment with settings where unions experience varying degrees of power in collective bargaining. Specifically, we use the adoption of right-to-work (RTW) laws across different jurisdictions in the U.S. RTW laws allow non-union members to enjoy the benefits of unionized bargaining without having to join a union or pay union dues. These laws weaken union powers, as they constrain unions' financial resources and reduce their organizing activity, ultimately impairing their effectiveness (see Ellwood and Fine, 1987; Holmes, 1998). We partition our sample according to whether or not union elections are held in states with RTW laws and find that the effect of unionization on bond values is far stronger in states without those laws. Indeed, for RTW-law states, unionization has negligible effects on bond values.

It is difficult to gauge economic connections between unionized labor and other stakeholders in the firm. Studies such as Faleye et al. (2006), Chen et al. (2012), and Bradley et al. (2013) argue that workers and creditors share a common interest in reducing firm risk in good states, since both parties hold fixed claims on firm values in those states. Accordingly, Faleye et al. show that firms with strong labor representation invest less in long-term assets, taking fewer risks. Chen et al. report regressions showing that bonds issued by firms in more unionized industries are more highly valued by investors because those firms are less likely to be target of acquisitions. Bradley et al. argue that unions stifle risky innovation by firms, measured by declines in patents and citation counts following unionization. These papers do not study conflicts between workers and creditors when dividing assets and sharing wealth in bankruptcy court. We contribute to the literature by characterizing this dynamic, showing that unionized firms incur higher costs in bankruptcy, reducing the value inherent in other creditors' claims.

This chapter also adds to a growing line of research on how human capital and organized labor influence firm financing. Berk et al. (2010) and Agrawal and Matsa (2013) argue that managers choose lower financial leverage to reduce workers' exposure to unemployment risk. Matsa (2010) argues that firms use financial leverage to raise their bargaining power against unions. This chapter contributes to this literature by showing that unions are ultimately costly to holders of unsecured debt claims, a result that helps explain the documented negative association between debt ratios and unionization. The analysis furthers the understanding of the impact of worker organization on corporate investors, an important facet of firm–labor relations.

The rest of the chapter is organized as follows. Section 4.2 describes the data. Section 4.3 presents our main results. Section 4.4 provides evidence regarding the channels through which unionization affects bond value. Section 4.5 provides a value transfer analysis of worker unionization. Section 4.6 concludes.

4.2 Data Description and Sample Selection

We piece together a number of databases to study the effect of unionization on bond values and bankruptcy costs. This section describes our data collection process, sampling, and variable construction methods.

4.2.1 Union Election Data

The NLRB provides detailed data on the results of elections to certify a representative union for a collective bargaining unit for the 1977–2010 period.[45] We gather information related to the time and location of each union election in the United States, the number of participating and eligible voters, the number of votes "for" and

[45] The 1977–1999 period data are used in Holmes (2006) and are available from Thomas Holmes's website (http://www.econ.umn.edu/~holmes/data/geo_spill/index.html). The 2000–2010 data are posted by the NLRB (http://www.data.gov/).

"against" unionization, and the company in which the election took place. Starting from the universe of elections recorded in the NLRB database, we follow prior literature in considering the set of elections with more than 50 voters. We then follow the algorithm used in Lee and Mas (2012) for matching company names in the NLRB to their identifier in the Center for Research in Security Prices (CRSP) database. We inspect every match manually and exclude incorrect matches. Our base union election sample includes 5,714 elections.

4.2.2 Bond Data

We collect information on publicly-traded corporate bonds from multiple data sources. Bond information for the 1977–1997 period is taken from the University of Houston Fixed Income Database (formerly Lehman Brothers Database). The University of Houston Database provides month-end bid prices for each bond issue, as well as issue-level characteristics such as accrued interest, yield to maturity, and credit ratings (see, e.g., Warga, 1998; Collin-Dufresne et al., 2001). For information after 1997, we use transaction-level data from the Mergent Fixed Income Securities Database (FISD) covering the 1997-2004 period and from Trade Reporting and Compliance Engine (TRACE) for the 2005-2011 period. Both providers offer comprehensive coverage of the bond market. We eliminate all canceled, corrected, and commission trades, following standard procedure in the literature (Bessembinder et al., 2006, 2009). We also follow existing studies in limiting our sample to U.S. dollar-denominated, fixed-coupon corporate debt issues that are senior, not puttable, and unsecured. Senior, unsecured bonds account for around 95% of all corporate bonds issued.[46]

4.2.3 Bond Return Computation

We compute cumulative abnormal returns (CARs) of corporate bonds over several time windows to gauge creditors' reactions to union elections. We use monthly frequencies in calculating bond returns since NLRB election dates are sometimes only reported with monthly precision. Using monthly data also helps alleviate concerns about the impact of market illiquidity on bond prices, as many bonds are infrequently traded. Following Bessembinder et al. (2009), we compute trade size-weighted bond prices for each trading day and use the price on the last trading day of the month as the month-end price. We then calculate the observed return (OR) for bond *b* in month *t* as:

$$OR_{b,t} = \frac{((P_{b,t} - P_{b,t-1}) + AI_{b,t})}{P_{b,t-1}}, \tag{4.1}$$

where P_t is the bond price at the end of month *t*, AI_t is the accrued interest of that month, and P_{t-1} is the bond price at the end of month $t-1$.

We calculate abnormal bond returns in three steps. First, we find a benchmark portfolio for each bond based on its risk. Specifically, we classify all senior, unsecured bonds into three-by-three portfolios according to their credit ratings and time-to-maturity.[47]

[46] Unsecured means the bond not being backed by assets, not based on secured lease obligation, nor a private placement exempt from registration under SEC Rule 144a.

[47] Bessembinder et al. (2009) show that default risk (proxied by credit ratings) and time-to-maturity are the two primary risk factors driving bond returns. Bonds are classified into 9 benchmark portfolios according to whether their credit rating is high grade (Aaa+-Aa3), medium grade (A1-Baa3), or speculative grade (Ba1 and below), and whether the remaining time to maturity is less than 10 years, between 10 and 20 years, or above 20 years.

We then calculate the value-weighted average return for each portfolio using the returns of every bond in that portfolio. For a given bond *b*, we find a portfolio with the closest credit rating and time-to-maturity as its benchmark portfolio.

Next, we calculate the abnormal return of bond *b* using its benchmark portfolio return as the bond's expected return (*ER*). The abnormal return (*AR*) for bond *b* is thus defined as the difference between the observed bond return (*OR*) and expected return:

$$AR_{b,t} = OR_{b,t} - ER_{b,t}. \tag{4.2}$$

The firm-level abnormal bond return is computed using the weighted average abnormal returns of all bonds issued by the firm, weighting each bond with its market value.[48] Formally, the abnormal bond return *AR* for firm *k* at time *t* is calculated as follows:

$$AR_{k,t} = \sum_{b=1}^{J} w_{b,t} AR_{b,t}, \tag{4.3}$$

where *J* is the number of bonds outstanding for firm *k*; *w* is the market value weight of bond *b* scaled by the total bond market value of firm *k*. Finally, we compute the cumulative abnormal return (*CAR*) following union election *i* for firm *k* from month $T_{i,1}$ to month $T_{i,2}$ as:

$$CAR\left(k, T_{i,1}, T_{i,2}\right) = \sum_{t=T_{i,1}}^{T_{i,2}} AR_{k,t}. \tag{4.4}$$

[48] We also use individual bonds (as opposed to firm-portfolio bonds) CARs to estimate price reactions to union elections. We obtain statistically and economically similar results to those reported below.

To be included in the sample, firms are required to have available monthly bond prices from one month prior to the union election to twelve months after the election. This allows us to examine time horizons similar to previous work on the effects of unionization (DiNardo and Lee, 2004; Lee and Mas, 2012) and event studies for bond returns (Warga and Welch, 1993; Eberhart and Siddique, 2002; Ellul et al., 2011). We winsorize bond CARs at the 1^{st} and 99^{th} percentiles to mitigate the influence of outliers. After matching bond CARs to the union election data, we are able to study a total of 721 election events.

4.2.4 Other Covariates

We extract firm fundamental information from Compustat and equity data from CRSP. We construct several measures of firm risk, including Altman's Z-score (*Z-score*), Ohlson's O-score (*O-score*), and Merton's distance to default (*Distance-Default*). We construct additional measures that describe firm characteristics: return on assets (*ROA*), asset size (*Size*), book-to-market ratio (*B/M*), liability-to-asset ratio (*Liability Ratio*), cash-to-asset ratio (*Cash*), and property, plant, and equipment-to-asset ratio (*Tangibility*). We also construct a bond liquidity measure, Bond Liquidity, following Batta et al. (2015). Detailed definitions of these variables are in Appendix 4.1. We winsorize covariates at the 1^{st} and 99^{th} percentiles.

4.2.5 Summary Statistics and Univariate Analysis

4.2.5.1 Union Elections

There is a well-documented decline in the unionization movement in the U.S. (see, e.g., Vedder and Gallaway, 2002; DiNardo and Lee, 2004). Our data sample spans 33 years, and Figure 4.1 shows that it captures a declining trend in establishment-level union elections. In the 2000s, in particular, the number of elections dropped sharply. Having a rich times series variation as our forcing variable is important for both statistical and economic inferences.

[Insert Figure 4.1 here]

The patterns present in our sample seem consistent with claims that union activity has declined due to factors such as changes in the political climate and public policy, managerial opposition to unions, development of labor-saving technologies, and increased competition from international trade (DiNardo and Lee, 2004). Despite the decline in union elections, key statistics of election results remain constant over time. For example, the median vote share in support of union is close to 45% over the last three decades. Although not displayed, the percentage of successful union elections has also remained constant over time, hovering around 25%.

Table 4.1 reports summary statistics for firm and bond characteristics. These statistics are based on election-year data. Overall, our sample firms are large and profitable, with an average book value of total assets of about $20 billion and an average return on assets of 9%. Those firms are also financially healthy and liquid, with an average Z-score of 3.6 and cash ratio of 4.3%. Firms in our sample typically have multiple bonds outstanding (average of 4) with above-investment grade credit ratings according to Moody's.

[Insert Table 4.1 here]

4.2.5.2 Bond Returns

An election event is defined as the month in which a union election vote takes place.[49] Observing the process through which unionization unfolds, we examine bond returns accumulated from the month prior to the vote to every 3 months up to one year following the event; i.e., $CAR(-1,\ 3)$, $CAR(-1,\ 6)$, $CAR(-1,\ 9)$, and $CAR(-1,\ 12)$.[50] Column (1) of Table 4.2 shows the abnormal bond returns following all union elections in our sample. On average, union-election bond CARs have a relatively small magnitude, ranging from -20 basis points during the 3-month post-election window to -100 basis points during the 12-month post-election window. Column (2) shows abnormal bond returns following all union winning elections, while column (3) shows the average bond CAR following all union losing elections. Notably, changes in bond values are not significantly different across those two groups.

[49] We use the union election date instead of the case closure date by the NLRB as the former date is more widely available for all election events and it is rare that the NLRB later overrules union election outcomes. Regardless of this choice, the NLRB closing date is around 10 days after the election in most cases and using NLRB closing date does not affect our results.
[50] Results are similar if we start the event window from the election month; i.e., *CAR(0, 3)*, …, *CAR (0, 12)*.

[Insert Table 4.2 here]

As we focus on comparisons between closely-won and closely-lost union elections, differences between bond CARs widen, becoming both economically and statistically significant. To illustrate this, we define as “close union losers" those elections in which the vote share for unionization is between 35% and 50% (inclusive), and as “close union winners" those in which the vote share for unionization is between 50% (exclusive) and 65%. Columns (4) and (5) of Table 4.2 show that the average $CAR(-1, 3)$ ($CAR(-1, 12)$) of close union winners is -60 (-180) basis points, while the average $CAR(-1, 3)$ ($CAR(-1, 12)$) of close union losers is only -10 (-60) basis points. Although coarse, these univariate comparisons already point to the negative relation between unionization and unsecured creditors' wealth that we identify below. To put our numbers in perspective, papers looking at corporate events that directly affect bondholders, such as LBOs (Warga and Welch, 1993) or fire sales driven by downgrades (Ellul et al., 2011), find CARs of the order of 700 to 870 basis points over periods ranging from 4 to 5 months.

4.3 The Impact of Unionization on Bond Prices

4.3.1 Test Strategy

There can be several ways for a union to gain legal representation for workers in business establishment. The most common path is through the following process. Union proponents must first file a petition supported by at least 30 percent of workers in the bargaining unit to obtain permission from the NLRB to conduct an election. The NLRB checks the petition's vote support and investigates employers’ claims regarding the legitimacy of the petition. The NLRB then schedules the election. The time lag between an initial petition and the vote is usually around seven weeks. Once the election is conducted, a union is formed if over 50 percent of eligible workers vote in favor. Within seven days following the election, parties can file objections to the NLRB regarding election procedures. If the Board rules the election as invalid, it will carry out a rerun (this happens only rarely). If valid, the union is certified to represent the bargaining unit, and the employer is obligated to negotiate with the union in good faith.

We examine the impact of unionization on corporate bonds using a regression discontinuity design (RDD). The RDD approach gauges effects from a “treatment" by identifying a cutoff above or below which a treatment is assigned. The underlying assumption is that for subjects in the vicinity of the cutoff, the treatment assignment is plausibly random (“local randomization”). In our setting, union representation status (the treatment) is determined by whether the vote share for union exceeds 50%. Due to the secret-ballot election mechanism required by law, there is a substantial level of ex-ante uncertainty about election outcomes. For close elections, it is unlikely for voters and other agents to exactly anticipate the election result. The nature of the secret ballot mechanism also makes it difficult for agents to manipulate the vote share around the cutoff. As such, close winners and close losers in union elections are likely to be ex-ante similar. By calculating the differential bond return reactions from close union winners and close losers, one should be able to infer the causal effect of workers' union status on bondholders' wealth.

4.3.2 Methodology

A simple RDD implementation consists of estimating two separate regressions on each side of the relevant assignment cutoff. One can use those two regression intercepts to compute the change in the outcome variable of interest at the cutoff. Formally, one estimates a polynomial regression model of order p on each side (*left and right*) of the cutoff c as follows:

$$Y = \alpha_l + (X - c) \times \beta_{l,1} + (X - c)^2 \times \beta_{l,2} + \cdots + (X - c)^p \times \beta_{l,p} + \epsilon, \qquad (4.5)$$

$$where\ X \leq c \text{ and}$$

$$Y = \alpha_r + (X - c) \times \beta_{r,1} + (X - c)^2 \times \beta_{r,2} + \cdots + (X - c)^p \times \beta_{r,p} + \epsilon, \qquad (4.6)$$

$$where\ X > c.$$

In our setting, c is 50% (the cutoff for a union win). Y is bond CAR, X is the union vote share in the election, and ϵ is an error term. Combining the two equations above, we can estimate the following pooled regression:

$$\begin{aligned} Y = \alpha_l + D \times \tau + \sum_{n=1}^{p} (X - 0.5)^n \times \beta_{l,n} \\ + \sum_{n=1}^{p} (X - 0.5)^n \times D \times (\beta_{r,n} - \beta_{l,n}) + \epsilon, \end{aligned} \qquad (4.7)$$

where D is an indicator for union victory that equals 1 if the vote share surpasses 50% and the union wins, and equals 0 if the union loses. The term τ equals $\alpha_r - \alpha_l$, capturing the jump in Y as the vote share just passes 50%. In other words, τ provides an estimate of the causal effect of unionization on corporate bonds' CARs.

Because the polynomial regression approach uses all available data in the estimation, it can achieve greater precision. The tradeoff, however, is that it imposes a particular functional form onto the relation between bond values and vote shares over a wide range of data, including data far away from the cutoff. Critically, strong functional form assumptions admit biases. Thus, we also consider a local linear regression approach, which is a non-parametric estimation using data within a small window h around the assignment cutoff. This approach reduces the potential for biases arising from global functional form assumptions at the cost of reducing statistical power due to the limit imposed on the sample size. Balancing the issues of bias and precision, we use both methods for estimation so as to ensure the reliability of our inferences.

Our local linear regressions can be represented similarly to the polynomial regressions discussed above, where one conveniently estimates the following model:

$$Y = \alpha_l + D \times \tau + (X - 0.5) \times \beta_l + D \times (X - 0.5) \times (\beta_r - \beta_l) + \varepsilon, \qquad (4.8)$$

where $0.5 - h \leq X \leq 0.5 + h$, and τ captures the causal effect of unionization on bond CARs.[51] In our local linear regression tests, we estimate models using both rectangular and triangular kernels. Each kernel method has advantages. Imbens and Lemieux (2008) and Lee and Lemieux (2010) recommend using rectangular kernels because they achieve higher

[51] The local linear regression is estimated by solving the following kernel-weighted least square problem on each side of the cutoff: $min_{\alpha,\beta} \sum_i \left(Y_i - \alpha - \beta(X_i - c)\right)^2 K(\frac{X_i}{h})$, where K is a kernel and h is the bandwidth.

efficiency. Fan and Gijbels (1996) and Cheng et al. (1997) show that triangular kernel is boundary-optimal, which is a desirable feature for sharp RDD applications.

4.3.3 Validity

We examine two necessary conditions to test the validity of our RDD approach: (1) continuity of the distribution of the forcing variable (union vote share) around the assignment cutoff and (2) continuity of other covariates around the cutoff. These two conditions help verify whether union voting serves as a locally randomized assignment.

We first examine whether the distribution of vote share is continuous around the 50% mark. If workers or firms could systematically manipulate vote shares around the 50% cutoff, we should expect to see markedly different vote shares densities just above or just below that point. One could also be concerned that workers only call for a vote when they anticipate a union win (even if marginal). In that case, we could see an upward jump in the union vote share distribution density after the 50% mark. To formally test the continuity of vote distribution, we follow the methodology proposed by McCrary (2008). It consists of a local linear regression combined with a Wald test to detect jumps in the marginal density of the forcing variable around the treatment assignment cutoff.[52] If there is a jump in the

[52] Formally, McCrary (2008) shows that the log difference between the density on the left and right sides of the cutoff $ln\hat{f}^r - ln\hat{f}^l$ follows an asymptotic normal distribution. The density $\hat{f}(p)$ at each point p is estimated as $\emptyset_1$, where $\{\emptyset_1, \emptyset_2\}$ minimize the average distance to the observed density through a kernel smoothing function: $L(\emptyset_1, \emptyset_2, p) = \sum_{j=1}^{J}\{Y_j - \emptyset_1 - \emptyset_2(X_j - p)\}^2 K(\frac{X_j - p}{h})\{1(X_j > c)1(p \geq c) + 1(X_j < c)1(p < c)\}$, where $K(\cdot)$ is a triangle kernel function; X_j is the midpoint of bin *j*; and Y_j is the observed density of bin *j*.

density of vote shares at the 50% threshold, the treatment is likely to be unsuitable for RDD estimation.

Figure 4.2 plots the distribution of vote share for union. The dots represent the average observed distribution density for each bin for union vote share. The solid line represents the fitted distribution density function from local linear regressions (90% confidence intervals are also shown). The graph displays continuity in the vote share distribution around the 50% cutoff, with a large overlap between the confidence intervals of density function on both sides of the cutoff. Consistent with the visual evidence, the Wald test shows that the distribution density of vote shares on two sides of the cutoff has a log difference of -0.09, with a standard error of 0.26. This estimate implies that in our sample of 721 elections, we can expect 15 closely-lost elections with vote share between 48.4% and 50%, and 14 close wins with vote share between 50% and 51.6%.[53] This difference is economically small and statistically insignificant.

[Insert Figure 4.2 here]

We next examine whether predetermined firm-level covariates are continuous around the 50% vote share cutoff. If there is an abrupt change in observable covariates around the cutoff, we cannot safely attribute the difference in bond values around the cutoff to unionization, as it might result from the changes in those covariates. Importantly, discontinuity of firm characteristics around the 50% cutoff may indicate that firms on the

[53] The bin size is 1.6%. Within the interval of (48.4%, 51.6%] around the cutoff, there is a probability of 2.1% (= 15 / 721) that an election is a close loss, and a probability of 1.9% that it is a close win. The -0.09 estimate represents the change in these probabilities $2.1\ \% \times (1 - 0.09) = 1.9\ \%$.

left side of the cutoff are systematically different from those on the right side of the cutoff, and should not be used as controls.

We test the assumption of continuity in firm-level covariates using local linear regressions under the RDD framework around the 50% vote share cutoff. We focus on firm characteristics that are relevant to bond valuation, including firm fundamental information given by *ROA, Size, B/M, Liability Ratio, Cash*. We also consider measures of credit risk such as *Z-score, O-score, and Distance-Default*. Finally, we also account for the liquidity of the treated bonds, Bond Liquidity. Table 4.3 shows the estimation results for these firm-level covariates using rectangular kernel and Imbens and Kalyanaraman's (2012) optimal bandwidths.[54]

The estimates in Table 4.3 do not point to any measurable changes in covariate values around the union election cutoff. We do not find evidence that close winners and close losers in union elections are different in relevant observable characteristics.

[Insert Table 4.3 here]

4.3.4 Graphical Analysis

We first use graphical analysis to identify the relation between vote shares for union and bond value changes following union elections. We divide the vote share into bins, calculating the conditional mean of the bond CAR corresponding to each bin. We then fit

[54] The results are robust to using triangular kernel or varying bandwidths. We obtain similar results using the polynomial regression approach. Those results are omitted for brevity but are readily available from the authors.

bond CARs on each side of the cutoff as separate quadratic functions of vote shares. We plot the average bond CAR against the midpoint of each bin. Figure 4.3 graphs the relation between bond *CAR(-1, 3)* and vote share for union. The solid lines depict bond CARs as fitted functions of vote shares; the dotted lines show 90% confidence intervals for those functions.

Figure 4.3 shows a distinct drop in bond CARs from the left side to the right side of the 50% cutoff, with non-overlapping confidence intervals. Bond CARs for close union winners decline over 180 basis points during the 3-month window following the election, while close losers CARs are nearly 0 during the same event window.

[Insert Figure 4.3 here]

4.3.5 Estimation Results

We consider multiple event windows to gauge the dynamics of the change in bond values. Starting from one month prior to the election time, we examine the effect of unionization on the bond returns accumulated through 3, 6, 9, and 12 months following the election. The gains from looking as far as a one-year horizon are two-fold. First, the effect of unionization on corporate securities can be hard to assess in the short run (Lee and Mas, 2012). Second, the lack of liquidity in bond markets is shown to prevent prices from reflecting information in the short run (Bao et al., 2011).

4.3.5.1 Polynomial Regressions

Table 4.4 shows the results from polynomial regressions. For every return window, we report results in stages. We first regress bond CARs on a union victory dummy (*Union Victory*), which equals one if the union wins the election, and zero otherwise. We then add to the specification the vote share for the union (*Vote Share for Union*), thus controlling for a linear relation between bond values and the level of support for union. Finally, we allow for nonlinear functional relations by adding higher order terms of vote share. Specifically, we add up to 4^{th}-order terms of vote share as well as the interaction between union victory dummy with these higher-order terms, allowing for different polynomial relations for victory and losing elections.[55]

[Insert Table 4.4 here]

Column (1) reports regression results for bond *CAR* (-1, 3) on a dummy variable indicating whether the union wins the representation election. The coefficient on the union victory dummy is insignificantly different from zero, indicating that the average abnormal bond returns that follow union victories are not different from the returns following union losses. Column (2) reports results accounting for a linear effect of vote shares on bond returns. The coefficient on the union victory dummy gains in magnitude and significance. Column (3) reports results when we allow for nonlinear relations between bond returns and vote shares. The union victory dummy attracts an economically and statistically significant

[55] Our inferences are insensitive to the choices of the order of the polynomial function.

coefficient. The estimate indicates that, following union elections, the bond prices of close-winner firms decrease by 250 basis points more than the bond prices of close-losers.

Columns (4) through (12) repeat the analyses in columns (1) through (3), examining the bond abnormal returns accumulated over longer event windows. Columns (6) and (9) show that unionization is associated with a 250 (480)-basis-points decline in bond prices over the 6 (9) months following a union's victory. Column (12) shows that, over the 12-month post-election window, the bond prices of close winners drop by 600 basis points more than the bond prices of close losers.

Importantly, the union-led declines in bond values that we identify are statistically and economically significant. The estimates imply that our sample bond investors lose, on average, $7 million over merely 90 days following union elections. The magnitude of those losses increases with the increase of the event window, reaching $17 million one year after the election.[56]

4.3.5.2 Local Linear Regressions

We employ local linear regressions to complement and verify the results returned from polynomial models. We use both rectangular and triangular kernels for estimation. We also consider several data bandwidths in our tests. In particular, we follow Imbens and Kalyanaraman (2012) and use the optimal bandwidth that minimizes the estimation errors

[56] Given our sample firms have, on average, $288 million in bond outstanding, one can estimate that close winners incur a $288 × 0.025 = $7 million greater loss in bond value during the 3-month window following union elections. Similarly, they are expected to observe a $17 million greater loss during the 12-month window (= $288 × 0.06).

over the entire data range. For robustness, we also report results based on 75% and 125% of their optimal bandwidth.[57]

Table 4.5 shows the results from local linear estimations using several different combinations of data bandwidths and kernel methods. Panel A (Panel B) shows the results from rectangular (triangular) kernel estimations. The test yields statistically and economically similar results across all specifications. The estimates suggest that unionization leads to significant declines in bond values over all event windows. Bondholders of close winners suffer, on average, a 210-basis-points larger decline in bond values over the 3 months following elections than the bondholders of close losers. The effect is magnified as we increase the event window. Over the 12-month post-election window, bondholders of close winners observe their bonds drop by 470-500 basis points more than bondholders of close losers. The magnitudes of these estimates are economically similar to those from polynomial regressions models.

[Insert Table 4.5 here]

The results from Tables 4.4 and 4.5 show that union victories in workers' representation elections lead to considerable bond price declines. The value impact we measure is statistically significant and economically meaningful, with effects persisting for

[57] The choice of bandwidth involves the standard tradeoff between precision and bias. A wider bandwidth improves precision by using more observations, but may admit biases as the function form may change over a larger interval. Using a narrower bandwidth yields less bias, but reduces estimation precision.

several months after the union vote. Unionization bears detrimental, lasting effects to unsecured creditors' wealth.

4.4 Mechanisms

While we have shown that unionization affects bond values, we have not shown whether this effect comes from the changes in bankruptcy likelihood or bankruptcy costs (or both). To gauge the effect of unionization on bankruptcy likelihood, we track the evolution of firm performance and financial health for several years after union elections take place, comparing close winners and close losers over time. To gauge the effect of unionization on bankruptcy costs, we gather information on bankruptcy proceedings and examine whether unionized firms experience longer, costlier bankruptcies.

4.4.1 Unionization and Bankruptcy Likelihood

For every firm in which an election takes place, we compute performance measures such as return on assets, book to market ratio, firm size, liability ratio, cash, tangibility, Z-score, O-score, and distance to default. For benchmarking, we subtract industry medians from each of these variables (3-digit SIC categorization). We then track the evolution of these industry-adjusted measures for up to five years following the election year. Finally, we use local linear regressions to test whether the changes in business performance measures are different for close winners than for close losers.

Table 4.6 reports RDD estimates associated with close union victories on each of the industry-adjusted metrics we consider. Panel A (Panel B) shows the results from rectangular (triangular) kernel estimations from 1- to 5-year windows following union elections. The coefficient for union victory is rarely significant, indicating that close winners and losers experience similar post-election performance. If anything, close winners show slightly better performance and lower liability ratios than close losers following elections.

[Insert Table 4.6 here]

The lack of performance deterioration for the union winning firms within five years following the election could indicate that the effect of unionization may only materialize in the longer term (more than five years). If this is the case, bonds that mature within five years following the election should not be affected by unionization. We investigate this possibility by examining whether bonds with less than five years to maturity at the election year experience any difference in returns across close winners and close losers. Table 4.7 repeats the RDD analyses of Table 4.5 for the subsample of bonds with less than five years to maturity. These bonds are associated with 416 election events. Even for this subsample we find that close union winners experience steeper declines in bond prices. In other words, short-term bond values decline in the aftermath of unionization even though there is no evidence that unionization will affect the odds the firm will go bankrupt in the short term. The value estimates are statistically significant, yet sensibly smaller in magnitude compared to those from the full sample analyses.

[Insert Table 4.7 here]

The results from Table 4.7 rule out the argument that unionization only affects corporate bond prices in the long term (more than five years after the union election). At the same time, the results from Table 4.6 suggest that unionization has no measurable influence over a firm's probability of default. To verify this claim in the data, we look at *de facto* 10-year bankruptcy rates of our sample firms following union elections. Figure 4.4 compares these bankruptcy rates for union election winners and losers. The red columns represent the post-election bankruptcy rates for union winners and the blue columns represent the post-election bankruptcy rates for union losers. For benchmarking, the grey columns represent the bankruptcy rates for firms that operate in the same industries as the union-loser firms, who have bonds outstanding, yet have not hosted an election during the election year of union-loser firms. We compare the bankruptcy likelihood of firms who hold union elections during each decade.

[Insert Figure 4.4 here]

The patterns in Figure 4.4 suggest that union winners do not experience higher bankruptcy rates than union losers or firms that have not hosted an election. If anything, bankruptcy rates are lower for union-win firms. A natural inference from these results is that the decline in bond value following elections is likely caused by the costs associated with bankruptcy, conditional on that event. We study this mechanism in turn.

4.4.2 Unionization and Bankruptcy Costs

We gather information on Chapter 11 bankruptcy cases from the UCLA-LoPucki Bankruptcy Research Database. The LoPucki database contains detailed records of petitions filed in U.S. Bankruptcy Courts since 1979. This database reveals unique information regarding corporate bankruptcy procedures, allowing us to contrast the judicial court processes experienced by unionized and non-unionized firms. We examine in-court costs incurred during bankruptcy from several margins. For this purpose, we obtain two datasets from the LoPucki library. The first contains information about Chapter 11 procedures, duration, and outcomes. It also reports whether the workers of the bankrupt firm were unionized before bankruptcy. We collect data from 1980 through 2010, a total of 546 bankruptcy cases. The second dataset contains in-depth information about fees and expenses paid in court. The dataset covers over one hundred of the largest bankruptcy cases in the country and provides information regarding the fees paid to various professionals involved in the bankruptcy cases considered. The dataset also reveals whether the firm was unionized prior entering bankruptcy.

We combine these data libraries to study and contrast differences in bankruptcy costs and procedures for unionized vis-à-vis non-unionized firms. Given the sample size and lack of information about union election dates and vote share for firms in the LoPucki dataset, in this subsection we resort to nonparametric and probabilistic approaches.

4.4.2.1 Bankruptcy Duration, Refinancing, Emergence, and Refiling

First, we examine whether unionization is associated with more prolonged, convoluted bankruptcy proceedings. LoPucki and Doherty (2011) show that the duration of bankruptcy cases is one of the most important determinants of fees and expenses incurred during litigation in the U.S. To study whether unions prolong the bankruptcy process, we compute the log of the number of days between the Chapter 11 filing date and the legal ending date of the case (*Duration*).[58] We contrast *Duration* across unionized and non-unionized firms using a matching estimator. Specifically, we match each unionized firm with four non-unionized firms that file for bankruptcy in the same year, according to their pre-bankruptcy characteristics such as firm size, liability ratios, cash, and asset tangibility, as well as the performance before bankruptcy (ROA). The treatment assignment of interest is given by *Union*, a dummy variable that equals one if the company has unionized workers prior to bankruptcy and zero otherwise. Column (1) of Table 4.8 shows the results. Unionized firms experience a significant longer period in bankruptcy court; around 27% (or 143 days) longer than non-unionized firms with similar characteristics who also filed for bankruptcy in the same year.

[Insert Table 4.8 here]

Next, we examine whether unionization is associated with a higher likelihood of the firm obtaining debtor-in-possession (DIP) financing during the bankruptcy process. DIP financing refers to the loans extended to firms under Chapter 11 protection. These loans have priority over all other debt issued by a company prior to bankruptcy, side-stepping absolute priority rules (see Dahiya et al., 2003; Chatterjee et al., 2004). Labor unions are likely to be in favor of DIP financing as it enables firms to continue operating during bankruptcy, and even emerge from bankruptcy. DIP-financed firms often face very high

[58] The end of a Chapter 11 case can be the confirmation of a reorganization plan by the judge, the conversion to Chapter 7 liquidation, or dismissal by the court, whichever is applicable.

debt levels when they emerge, and pre-existing bondholders are wary of DIP financing since, in the emerged entity, DIP financiers receive a higher seniority.[59]

To examine the relation between unionization and DIP financing, we define an indicator variable *DIP* that equals one if the firm receives DIP financing in bankruptcy and zero otherwise. We use a logistic estimator to regress *DIP* on *Union*. The model includes the same set of covariate used in our matching estimation as well as year-fixed effects. Column (2) of Table 4.8 reports the result from this test. The estimated marginal effect suggests that, compared to non-unionized counterparts, unionized firms are 19% more likely to obtain DIP financing during bankruptcy. This result is both statistically and economically significant, indicating that firms with unionized labor are more likely to pursue refinancing maneuvers that reduce bondholders' senior claims over corporate assets in bankruptcy court.

Finally, we examine whether unionization is associated with a higher likelihood of the firm emerging from bankruptcy and refiling for bankruptcy again after emergence. If unionization leads to inefficient reorganization processes, we may observe more occurrences of firms emerging from Chapter 11, yet falling back into bankruptcy afterwards. To test this conjecture, we construct an indicator for a firm emerging from Chapter 11 bankruptcy (*Emergence*) and an indicator for the firm refiling for bankruptcy after emergence (*Refiling*). We repeat the analysis for DIP financing, regressing the indicators Emergence and Refiling on the unionization dummy Union in a logistic model.

[59] During Brookstone's bankruptcy process, bondholders vehemently argued that DIP financing undercut the value of their bonds. See “Brookstone in Deal with Vendors as Bondholders Clash,” Wall Street Journal.

Columns (3) and (4) of Table 4.8 report the results. The marginal effects indicate that unionized firms are 14% more likely to emerge from Chapter 11 than non-unionized firms. After emergence, however, unionized firms are 6% more likely to refile for bankruptcy.

4.4.2.2 Bankruptcy Fees and Expenses

The LoPucki database provides detailed information on court fees and expenses related to 102 of the largest bankruptcy cases of in the U.S. between 1998 and 2007. To provide an intuitive cost comparison between unionized and non-unionized bankruptcies, we rank firms by total assets and identify the 10 largest unionized and the 10 largest non-unionized firms in the database. We then plot the fees and expenses these 20 firms paid to attorneys and financial advisors during bankruptcy. Figure 4.5 displays the relevant expenses, with the red hollow dots indicating unionized firms and the blue solid dots indicating non-unionized firms. The figure suggests that unionized firms pay much higher fees to (both) attorneys and financial advisors during bankruptcy relative to non-unionized firms of comparable sizes.

[Insert Figure 4.5 here]

Formally, we test how unions affect the costs incurred during bankruptcy across the following dimensions: (1) total fees and expenses paid in court, as an indication of overall bankruptcy costs, (2) the number of professional firms hired during the bankruptcy process, (3) fees paid to all attorneys, and (4) fees paid to creditors committees' attorneys. We do so by matching each unionized firm in bankruptcy court with four non-unionized firms according to pre-bankruptcy firm characteristics, including *ROA, Size, Liability Ratio,* *Cash, and Tangibility*. We require treated and control matches to file for bankruptcy in the same year. With the matched sample, we compare the log amount of bankruptcy court costs between the unionized and non-unionized firms. The results shown in Table 4.9.

[Insert Table 4.9 here]

The results from our matching procedure point to a consistent pattern across all dimensions of in-court bankruptcy costs. Unionized firms pay, on average, $15 million (49%) more overall expenses and hire 4 (25%) more professionals during the bankruptcy process. These firms are also likely to pay $10 million (62%) more to attorneys than non-unionized firms. With unions being on the creditors' committee, firms pay $1.2 million (47%) more to the attorneys hired by the creditors' committee. Simply put, bankruptcy is far more costly for unionized firms than for comparable non-unionized firms.

Taken altogether, the analyses of this section show that unionization does not lead to deterioration in firm performance or an increase in default risk. Notably, however, unionization is associated with prolonged bankruptcy processes, repeated bankruptcy filings, and significantly higher costs incurred in bankruptcy court, all of which have adverse impact on unsecured creditors' claims. Our results suggest that unionization is likely to affect bond value by increasing bankruptcy costs, rather by increasing the likelihood of bankruptcy.

4.4.3 Heterogeneity

4.4.3.1 Firm Characteristics

We exploit cross-sectional variation in firm characteristics to verify the argument that unionization affects bondholders through bankruptcy costs. Bond values reflect the product of default likelihood and bankruptcy costs. If unionization reduces bond values by increasing bankruptcy costs, this impact should be stronger when firms are more likely to go bankrupt in the first place. In other words, as the threat of bankruptcy looms, bondholders should become increasingly concerned about the cost impact of unionization.

To examine this conjecture, we partition our sample into financially-distressed and financially-healthy firms, and then conduct RDD analyses on bond CARs for each subsample. We expect the marginal impact of unionization on bond values to be stronger for distressed firms than for healthy firms. We use several measures of financial distress to conduct this comparison. First, we partition the sample according to Altman's Z-score, identifying a subsample of distressed (healthy) firms whose Z-scores are below 1.8 (above 3). Using Ohlson's O-score, we assign firms with O-scores above (below) 0.5 to the distressed (healthy) subsample. Based on Merton's distance to default, we assign firms in the bottom (top) quintile of our Distance-Default proxy to the distressed (healthy) subsample. Finally, we partition the sample firms according to credit ratings provided by Moody's and classify as distressed (healthy) those firms with speculative grade (investment grade) credit ratings.

Table 4.10 reports union near-wins RDD estimates for financially-distressed and financially-healthy firms. Across virtually all measures of distress, unionization has a large, highly-significant impact on the bonds of distressed firms, but only a small, insignificant impact on the bonds of healthy firms. Results in Panel A show that close winners with low Z-scores lose 780 basis points over the course of 3 months following the union election. In contrast, close winners with high Z-scores only lose 90 basis points, which is insignificantly different from zero. Similarly, close winners with speculative ratings suffer a drop of 620 (1,520) basis points in bond values over 3 (12) months following the election, while close winners with investment ratings observe only a 110 (180)-basis-point drop.

[Insert Table 4.10 here]

The estimates in Table 4.10 generate economically sensible magnitude for union-induced bankruptcy costs. The results support the argument that the effect of unionization largely stems from increased bankruptcy costs, and suggest that unionization has a far stronger effect on bondholders' wealth when the firm is facing a high risk of default.

4.4.3.2 Union Characteristics

An important argument underlying our story is that unionization increases the collective bargaining power of workers, ultimately affecting bondholders. To examine this claim, we explore regional variation in the power of the union movement. In particular, we take advantage of state-level right-to-work (RTW) laws that alter unions' bargaining position. RTW laws allow employees who are not union members to enjoy the benefits of unions without paying dues. Research shows that RTW laws reduce unions' resources, limiting their powers (see, e.g., Ellwood and Fine, 1987; Holmes, 1998; Matsa, 2010).[60] We conjecture that in RTW-law states unionization is likely to increase labor's bargaining power to a lesser extent than in states without RTW laws. We exploit this wrinkle to test if unionization has differential effects on bond prices according to whether the state in which the firm is incorporated has passed a RTW law.

We partition our sample of union elections into two subsamples. One consists of 266 elections taking place in states that have passed RTW laws when a union vote takes place. The other consists of 455 elections in states that have not passed those laws. Despite the size difference, the two subsamples have similar rates of union victory and similar vote share distributions (insignificantly different according to Kolmogorov-Smirnov distribution tests). We also find that the continuity conditions necessary to conduct our RDD tests hold across both RTW and non-RTW law states.

Table 4.11 shows the RDD results. In states that have not passed RTW laws, unionization has a large and significant impact on bond values. Relative to close losers, bond prices of close winners drop by 220 (670) basis points over the 3 (12)-month window following union elections. In states with RTW laws, in contrast, the impact of unionization on bond values is small and insignificantly different from zero.

[Insert Table 4.11 here]

[60] Eren and Ozbeklik (2011) report that union membership declined by nearly 15% after Oklahoma adopted RTW laws.

The estimates in Table 4.11 imply that the impact of unionization on corporate bond values arises from the increased collective-bargaining power. To wit, the negative impact of unionization on unsecured creditors' wealth in bankruptcy is weakened in states where the legislature has passed laws that undermine the power of unions.

4.5 Assessing Value Transfers

We have shown that worker unionization brings losses to unsecured creditors. We have also shown that some of those losses are attributable to costs arising from in-court bankruptcy proceedings. It is important that we put those costs (total bond losses and court costs) into perspective, fleshing out magnitudes and assessing the consequences they bring to workers and creditors. Notably, the bankruptcy process allows - even if only temporarily - for workers to continue receiving wages and enjoying benefits. This can be seen as a wealth transfer amongst corporate insiders. This welfare effect stands in contrast to transfers from firm insiders to outside parties, such as attorneys, financial advisors, and other professionals involved in court litigation. While it is difficult to measure these wealth effects, our setting allows us to perform a back-of-the-envelope calculation that helps tease out some of the magnitudes involved.

We start by calculating the total value loss to bondholders induced by unionization. Given that the effect of unionization deepens according to firms' distress level (see Section 4.4.3.1), we partition our sample into two distress subsamples (based on firms' Z-scores) and calculate bondholder losses separately for each subsample. For example, among financially-distressed firms (whose Z-score ≤ 1.8), a close winner experiences a 1,500-

basis-point decline in bond values over the 12-month period following the union election (cf. Table 10). Given that the average distressed firm in our sample has $1,373 million in bonds outstanding, this estimate translates to an average of $206 million total value loss for bondholders. Analogously, in the 12-month period following union elections, bondholders of financially-healthy firms (Z-score > 3) experience a $20 million drop in the value of their claims.

Next, we estimate bondholders' losses that arise from the increases in court costs attributable to unionization. Estimates of direct bankruptcy costs range from as low as 2.8% (cf. Weiss, 1990) to 6% (Altman, 1984) of firms' total asset values. We choose a conservative figure of 2.8%. The estimations in Table 4.9 suggest that unionization is associated with 49% higher bankruptcy costs. Accordingly, we take that unionization is associated with a higher bankruptcy cost equivalent to 1.4% of a firm's total asset value (= 49 % × 2.8%). The average distressed firm in our sample has a total asset value of $34.3 billion, thus we estimate that bankruptcy is likely to cost $471 million more for unionized firms (= 1.4 % × $ 34.3 billion).

The last element we need to consider is the probability that firms default. We estimate default probabilities according to firms' credit ratings and we employ two measures of default. We first use historical default probabilities from Moody's (cf. Canter et al., 2007). We also use risk-neutral default probabilities estimated by Almeida and Philippon (2007), who account for investors' risk preference, implying default probabilities that are higher than historical occurrences.[61] Given that our sample of distressed firms have an average credit rating of Ba1, they has a historical default probability of 10%, and a risk-neutral default probability of 39%.

We note that only half of the firms that file for bankruptcy go into Chapter 11 (Graham et al., 2014). We thus estimate an expected explicit bankruptcy cost of around $24 million for distressed firms under the historical default probability (471 × 10% × 50%). Under the risk-neutral default probability, we expect bankruptcy costs to be $92 million (471 × 39% × 50%), which is a significant fraction of the $206 million total bondholder losses. Similar calculations for healthy firms imply that unionization is associated with a $0.3 million (historical probability) or a $8.3 million (risk-neutral probability) increase in expected bankruptcy costs.

Figure 4.6 depicts the results of our calculations, with the red bars indicating bondholders' total value losses from unionization, the blue bars indicating the increases in bankruptcy costs due to unionization according to historical default probabilities, and the grey bars indicating the increases in bankruptcy costs according to risk-neutral default probabilities. Our estimations show that both the total bond value losses and the increases in bankruptcy costs from unionization are aggravated by firms' financial distress. Notably, according to the risk-neutral estimation, around half of bondholders' losses are due to

[61] Risk-neutral measures take into account investors' disutility when defaults happen in low consumption states. It correctly prices an Arrow-Debreu security that pays off $1 in different states of the world. As corporations are more likely to default in bad economic times, defaultable bond prices will be more heavily discounted compared to their actual historical default rates (Almeida and Philippon, 2007). In other words, risk-neutral default probabilities are higher than historical probabilities so that the securities are priced fairly.

greater in-court bankruptcy costs. The main message of our estimates is that a large proportion of the value loss observed by the bondholders of distressed firms is not transferred to workers in bankruptcy, but instead dissipated through the court process.

[Insert Figure 4.6 here]

4.6 Concluding Remarks

Using a comprehensive sample of union elections spanning four decades, we study the effects of unionization on bond values using a regression discontinuity design. We find that union victories lead to significant declines in bond prices. As we investigate channels through which unionized labor affects bond values, we find that unionization causes significant increases in bankruptcy costs yet negligible changes in bankruptcy odds. Our estimates suggest that unionized firms spend 50% more in direct bankruptcy costs than non-unionized firms. The impacts of unionization on bond values are stronger for financially distressed firms and those in states with Right-to-Work laws.

In all, this chapter sheds new light on how the bargaining power of labor unions can affect financial stakeholders of the firm, unsecured creditors in particular. We show that unions can make bankruptcy more costly, prolonged, and convoluted by the way unionized workers' rights are assigned under Chapter 11 proceedings. Our study shows that the rights of unions in court are recognized by creditors, who in turn price it into firms' funding costs. The analysis provides insights for researchers and policymakers in understanding how firm–labor relations shape corporate access to credit.

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Appendix 4.1: Variable Definitions

Vote Share for Union: The ratio of number of employees in the unit voting for the union to number of employees in the unit eligible to vote. Data source: NLRB

Union Victory: A dummy variable that equals one if the union gains more than half of the votes and obtain the legal representation status and equals zero otherwise. Data source: NLRB

ROA: EBIT/total assets. Data source: Compustat

Size: ln(Total assets). Data source: Compustat

B/M: The ratio of book value of equity to market value of equity. Data source: Compustat and CRSP

Liability Ratio: Total liability/total assets. Data source: Compustat

Cash: The ratio of cash and short-term investments to total assets. Data source: Compustat

Tangibility: The ratio of property, plant, and equipment to total assets. Data source: Compustat

Z-score: 3.3 × EBIT/total assets + 1.0 × sales/total assets + 1.4 × retained earnings/total assets + 1.2 × working capital/total assets. Data source: Compustat

O-score: -1.32 - 0.407 × size + 6.03 × liability ratio - 1.43 × working capital/total assets+ 0.0757 × current liabilities/current assets - 1.72 X - 2.37 × net income/total assets - 1.83 × funds from operations/total liabilities + 0.285 Y - 0.521 × (net income (t) - net income (t − 1))/(|net income (t) | + |net income (t − 1) |), where X is an indicator for total liabilities being larger than total assets, and Y is an indicator for net losses in the past two years. Data source: Compustat

Distance-Default: Distance to default measure as in Bharath and Shumway (2008). *Distance-Default*=$\frac{\ln\left(\frac{V}{F}\right)+\left(\mu-0.5\sigma_V^2\right)T}{\sigma_V\sqrt{T}}$. Data source: Compustata and CRSP

Bond Liquidity: The monthly normalized standard deviation of bond price (normalized by the monthly average price) divided by the monthly trading volume (in millions $). If a firm has multiple bonds outstanding, bond liquidity is the average liquidity across all bonds outstanding. Data source: TRACE and FISD

Duration: The log of the number of days from the day on which the bankruptcy case was filed to the day on which the judge signed the order confirming a plan of reorganization or to the day on which the Chapter 11 case was converted to Chapter

7 or dismissed, whichever is applicable. Data source: UCLA-LoPucki Bankruptcy Research Database

Total Fees and Expenses Paid in Court: The log amount of fees and expenses awarded by the court to bankruptcy case. Data source: UCLA-LoPucki Bankruptcy Research Database

Number of Legal and Financial Professionals Hired: The log number of professional firms filing fee applications in the bankruptcy case. Data source: UCLA-LoPucki Bankruptcy Research Database

Fees Paid to Attorneys: The log amount of fees and expenses awarded to attorneys of the bankruptcy case by the court. Data source: UCLA-LoPucki Bankruptcy Research Database

Fees Paid to Creditor Committee's Attorneys: The log amount of fees and expenses to Creditor Committee's lead attorney. Data source: UCLA-LoPucki Bankruptcy Research Database

Table 4.1

Summary statistics

This table provides summary statistics of the variables of interests in our sample, including election information, firm characteristics, and bond statistics. Election Year is the year in which the election was held. *ROA*, *Size*, *Liability Ratio, Cash, Tangibility*, *B/M*, *Z-score*, *O-score*, *and Distance-Default* are based on the information collected during the year of the election. *# Bonds per Firm, Bond Maturity and Bond Rating* are based on the information during the month of the election. *# Bonds per Firm* is the average number of bonds outstanding for a firm. *Bond Maturity* measures the time to maturity for a bond. *Bond Rating* is the Moody's credit rating on the bonds. When a firm has multiple bonds, we use a simple average to measure a firm's *Bond Maturity* and *Bond Rating*. The sample period is from 1977 to 2010.

	N	Mean	Std. Dev.	Median	5 Pct.	95 Pct.
Election Year	721	1990.03	9.45	1989	1978	2007
# Valid Votes	721	232.877	633.143	118	55	756
Vote Share for Union	721	0.414	0.187	0.384	0.165	0.800
ROA	698	0.090	0.045	0.085	0.025	0.166
Size	703	8.829	1.207	8.862	6.761	10.609
B/M	673	0.770	0.497	0.670	0.193	1.669
Liability Ratio	703	0.662	0.179	0.663	0.457	0.871
Cash	703	0.043	0.043	0.028	0.003	0.132
Tangibility	703	0.407	0.221	0.382	0.230	0.596
Z-score	604	3.586	2.434	3.126	1.371	6.999
O-score	703	-0.921	1.453	-0.988	-2.826	1.205
Distance-Default	673	7.014	3.964	6.568	2.035	14.572
# Bonds per Firm	721	4.080	3.590	3	1	46
Bond Maturity (years remaining)	721	13.210	7.070	13	0.710	34.660
Bond Rating (Aaa+=1, Aaa=2, …, C=22)	721	8.21	3.77	8	2	19.67

Table 4.2

Bond CARs following union elections, event study

This table reports average bond CARs following union elections. *CAR* (T_1, T_2) denotes the cumulative abnormal return from month T_1 to month T_2 relative to the union election month. Column (1) summarizes the average bond CAR for all elections in our sample. Column (2) shows average bond CARs following union victory elections, where unions receive more than 50% of the votes. Column (3) shows average bond CARs following union loss elections; i.e., unions receive 50% or less of the vote. Column (4) shows average CARs following close wins; the vote share for union is between 50% (exclusive) and 65%. Column (5) shows average bond CARs following close losses; the vote share for union is between 35% and 50% (inclusive).

	(1)	(2)	(3)	(4)	(5)
	All Elections	Union Victory	Union Defeat	Close Win	Close Loss
CAR (-1, 3)	-0.002**	-0.002	-0.002*	-0.006**	-0.001
	(-0.001)	(-0.002)	(-0.001)	(-0.003)	(-0.002)
CAR (-1, 6)	-0.004***	-0.004	-0.004***	-0.009**	-0.005**
	(0.001)	(0.003)	(0.001)	(0.004)	(0.002)
CAR (-1, 9)	-0.006***	-0.009**	-0.005***	-0.013**	-0.003
	(0.002)	(0.004)	(0.002)	(0.005)	(0.003)
CAR (-1, 12)	-0.010***	-0.013***	-0.009***	-0.018***	-0.006**
	(0.002)	(0.004)	(0.002)	(0.007)	(0.003)

Table 4.3

Continuity of firm characteristics

This table reports the results from local linear regressions for firm characteristics in the election year. *Union Victory* is a dummy variable that equals one if a union receives more than 50% of votes and equals zero otherwise. Only the coefficients of *Union Victory* are reported. We use rectangular kernel and the optimal bandwidth defined in Imbens and Kalyanaraman (2012).

	Union Victory Coefficient	Std. Err.	Z-statistics	P-value
ROA	-0.003	0.012	-0.250	0.801
Size	-0.022	0.363	-0.061	0.952
Book-to-Market	-0.157	0.151	-1.039	0.299
Liability Ratio	0.034	0.042	0.809	0.411
Cash	0.006	0.01	0.637	0.524
Tangibility	-0.013	0.038	-0.330	0.740
Z-score	-0.187	0.178	-1.051	0.294
O-score	0.052	0.285	0.182	0.855
Distance-to-Default	-0.983	0.991	-0.992	0.321
Bond Liquidity	0.006	0.01	0.662	0.508

Table 4.4

Polynomial regression results for bond CARs

This table reports the results from polynomial regression analyses for bond CARs following union elections. *Union Victory* is a dummy variable which equals 1 if the union wins the election and equals 0 if not. *Vote Share for Union* is the percentage share of votes in support of union in the election.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	(-1, 3)	(-1, 3)	(-1, 3)	(-1, 6)	(-1, 6)	(-1, 6)	(-1, 9)	(-1, 9)	(-1, 9)	(-1, 12)	(-1, 12)	(-1, 12)
Union Victory	-0.000	-0.007	-0.025**	0.000	-0.003	-0.025*	-0.003	-0.012**	-0.048***	-0.003	-0.016**	-0.060***
	(0.003)	(0.004)	(0.011)	(0.003)	(0.005)	(0.013)	(0.004)	(0.006)	(0.016)	(0.004)	(0.007)	(0.018)
Vote Share for Union		0.018*	0.073		0.011	-0.025		0.027**	0.055		0.038**	0.165
		(0.009)	(0.165)		(0.011)	(0.197)		(0.013)	(0.236)		(0.015)	(0.266)
(Vote Share for Union)^2			-0.024			-0.076			0.334			1.430
			(1.467)			(1.749)			(2.099)			(2.367)
(Vote Share for Union)^3			-2.084			-0.581			0.443			4.437
			(4.856)			(5.791)			(6.950)			(7.837)
(Vote Share for Union)^4			-4.257			-1.345			-0.703			3.822
			(5.294)			(6.313)			(7.576)			(8.543)
Union Victory			0.344			0.661*			0.949**			1.032*
×Vote Share for Union			(0.327)			(0.389)			(0.467)			(0.527)
Union Victory			-2.995			-4.018			-6.665			-8.965*
×(Vote Share for Union)^2			(2.851)			(3.400)			(4.081)			(4.601)
Union Victory			11.645			10.757			14.063			12.917
×(Vote Share for Union)^3			(9.069)			(10.814)			(12.978)			(14.634)
Union Victory			-5.832			-7.085			-10.101			-16.855
×(Vote Share for Union)^4			(9.345)			(11.144)			(13.374)			(15.080)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	721	721	721	721	721	721	721	721	721	721	721	721
R-squared	0.129	0.134	0.152	0.161	0.163	0.176	0.167	0.172	0.188	0.153	0.161	0.178

Table 4.5

Local linear regression results for bond CARs

This table reports the results from local linear regression analysis for bond CARs following the NLRB election month. $CAR\ (T_1, T_2)$ denotes the cumulative abnormal return from month T_1 to month T_2 relative to the union election month. We report the coefficient on *Union Victory* for each dependent variable and specification. Panels A presents results based on estimations with rectangular kernels, and panel B presents results based on estimations with triangular kernels.

Panel A: Coefficients of Union Victory (Rectangular)

	CAR (-1, 3)	*CAR (-1, 6)*	*CAR (-1, 9)*	*CAR (-1, 12)*
Optimal	-0.021***	-0.022*	-0.040**	-0.047**
	(0.008)	(0.012)	(0.018)	(0.021)
Observations	370	324	263	295
75%	-0.021**	-0.023*	-0.050**	-0.061**
	(0.009)	(0.013)	(0.022)	(0.025)
Observations	275	239	197	227
125%	-0.018***	-0.021**	-0.036**	-0.043**
	(0.007)	(0.009)	(0.016)	(0.018)
Observations	460	402	335	270

Panel B: Coefficients of Union Victory (Triangular)

	CAR (-1, 3)	*CAR (-1, 6)*	*CAR (-1, 9)*	*CAR (-1, 12)*
Optimal	-0.020***	-0.021*	-0.041**	-0.050**
	(0.008)	(0.011)	(0.018)	(0.022)
Observations	467	405	340	379
75%	-0.022**	-0.020	-0.043**	-0.055**
	(0.009)	(0.013)	(0.021)	(0.026)
Observations	350	298	254	279
125%	-0.018***	-0.020**	-0.038**	-0.044**
	(0.007)	(0.010)	(0.016)	(0.018)
Observations	549	492	429	468

Table 4.6

Performance changes 5 years following election

This table provides the results on the changes of industry-adjusted performance from local linear regressions. The dependent variables are the changes of firm characteristics related to performance or risk. Only the coefficients of *Union Victory* (standard errors) are reported. We use the optimal bandwidth defined in Imbens and Kalyanaraman (2012) for estimation.

Panel A: Coefficients of Union Victory (Rectangular)									
Year	*ROA*	*Size*	*B/M*	*Liability Ratio*	*Cash*	*Tangibility*	*Z-score*	*O-score*	*Distance-Default*
1	-0.003	0.033	-0.062	-0.012	0.001	-0.005	0.000	0.048	1.243
	(0.009)	(0.148)	(0.080)	(0.016)	(0.252)	(0.010)	(0.097)	(0.150)	(0.751)
2	-0.008	-0.053	0.031	-0.025*	-0.001	0.009	-0.185	-0.114	-0.849
	(0.007)	(0.071)	(0.077)	(0.014)	(0.009)	(0.014)	(0.406)	(0.222)	(0.855)
3	0.017**	-0.081	-0.068	0.001	0.001	0.018	-0.081	-0.223	0.474
	(0.007)	(0.09)	(0.076)	(0.021)	(0.008)	(0.022)	(0.495)	(0.245)	(0.914)
4	0.016**	0.020	-0.044	-0.015	0.013	0.016	0.692	-0.221	1.293
	(0.007)	(0.136)	(0.120)	(0.022)	(0.012)	(0.018)	(0.899)	(0.312)	(0.909)
5	0.008	0.076	0.041	0.014	-0.021*	0.019	0.576	-0.442	0.426
	(0.012)	(0.140)	(0.113)	(0.025)	(0.011)	(0.026)	(0.675)	(0.328)	(0.992)

Panel B: Coefficients of Union Victory (Triangular)									
Year	*ROA*	*Size*	*B/M*	*Liability Ratio*	*Cash*	*Tangibility*	*Z-score*	*O-score*	*Distance-Default*
1	-0.006	0.119	-0.059	-0.005	0.002	-0.007	0.132	0.005	1.079
	(0.010)	(0.163)	(0.082)	(0.016)	(0.008)	(0.009)	(0.258)	(0.143)	(0.686)
2	-0.007	-0.053	0.010	-0.033**	0.001	0.008	-0.051	-0.103	-0.416
	(0.007)	(0.069)	(0.073)	(0.014)	(0.009)	(0.014)	(0.377)	(0.217)	(0.820)
3	0.011	-0.053	-0.062	0.003	0.003	0.022	0.061	-0.321	0.573
	(0.007)	(0.085)	(0.075)	(0.021)	(0.007)	(0.023)	(0.437)	(0.232)	(0.807)
4	0.014*	-0.009	-0.069	-0.018	0.017	0.020	0.435	-0.372	1.029
	(0.007)	(0.131)	(0.119)	(0.020)	(0.012)	(0.019)	(0.597)	(0.281)	(0.796)
5	0.007	0.045	0.032	0.014	-0.019*	0.013	-0.105	-0.463	0.290
	(0.012)	(0.132)	(0.113)	(0.025)	(0.010)	(0.028)	(0.548)	(0.298)	(0.928)

Table 4.7

Bond CARs for issues maturing within 5 years

This table reports the test results from local linear regressions on the impact of unionizations on bonds matured within 5 years after the election year. Only the coefficients of *Union Victory* (standard errors) are reported. The dependent variable is bond CAR.

Panel A: Coefficients of Union Victory (Rectangular)

	CAR (-1, 3)	*CAR (-1, 6)*	*CAR (-1, 9)*	*CAR (-1, 12)*
Optimal bandwidth	-0.012*	-0.037***	-0.041***	-0.025*
	(0.007)	(0.013)	(0.015)	(0.015)
Observations	296	191	185	249
75% Optimal bandwidth	-0.017**	-0.039**	-0.048***	-0.038**
	(0.008)	(0.016)	(0.019)	(0.019)
Observations	236	139	132	183
125% Optimal bandwidth	-0.011*	-0.034***	-0.034***	-0.029**
	(0.006)	(0.012)	(0.013)	(0.014)
Observations	344	237	224	288

Panel B: Coefficients of Union Victory (Triangular)

	CAR (-1, 3)	*CAR (-1, 6)*	*CAR (-1, 9)*	*CAR (-1, 12)*
Optimal	-0.014*	-0.036***	-0.042***	-0.033**
	(0.007)	(0.013)	(0.015)	(0.016)
Observations	351	239	228	302
75%	-0.016**	-0.038**	-0.048***	-0.039**
	(0.008)	(0.015)	(0.018)	(0.019)
Observations	283	185	172	237
125%	-0.012*	-0.034***	-0.037***	-0.028*
	(0.006)	(0.012)	(0.013)	(0.015)
Observations	392	287	275	338

Table 4.8

The impact of unionization on bankruptcy process

This table analyzes the impact of unionization on bankruptcy procedures. *Duration* is defined as the log of the number of days from the bankruptcy filing date to the conclusion of Chapter 11 bankruptcy case. *DIP* is a dummy variable that equals one if a firm obtains Debtor-in-Possession financing during bankruptcy and zero otherwise. *Emergence* is a dummy variable that equals one if the company emerged from bankruptcy and zero otherwise. *Refiling* is a dummy variable that equals one if the emerging company refiled bankruptcy and zero otherwise. *Union* is a dummy variable that equals one if the bankruptcy firm had unionized workers before bankruptcy. Column (1) presents the result from a matching estimator, where we match each unionized firm with four non-unionized firms that file bankruptcy in the same year, with similar characteristics including *ROA, Size, Liability Ratio, Cash, and Tangibility*. Columns (2) through (4) present results from logistic regressions that control for the same set of firm characteristics and year-fixed effects. In each column, the coefficient (heteroscedasticity-robust standard error) on *Union* is reported.

	(1)	(2)	(3)	(4)
Dep. Var.	*Duration*	*DIP*	*Emergence*	*Refiling*
Union	0.274***	1.098***	0.753***	0.602**
	(0.099)	(0.373)	(0.241)	(0.301)
Observations	512	228	492	487

Table 4.9

The impact of unionization on bankruptcy costs

This table compares the fees and expenses during bankruptcy incurred by unionized and matched non-unionized firms. We compare bankruptcy fees across the following dimensions: (1) *Total Fees and Expenses Paid* in Court, measured as the log amount of total fees and expenses incurred in the bankruptcy court; (2) *Number of Legal and Financial Professionals Hired*, the log number of legal and financial professionals, (3) *Fees Paid to Attorneys*, the log amount of fees and expenses awarded to attorneys, indicating the legal costs among the expenses; and (4) *Fees Paid to Creditor Committee's Attorneys*, the log amount of fees and expenses awarded to the creditors committee's lead attorney, indicating the costs related to creditors committee's lead attorney. We compare these dimensions of bankruptcy costs by matching a unionized firm with four non-unionized firms that file for bankruptcy in the same year, with similar characteristics including *ROA, Size, Liability Ratio, Cash, and Tangibility*.

	(1)	(2)	(3)	(4)
	Total Fees and Expenses Paid in Court	*Number of Legal and Financial Professionals Hired*	*Fees Paid to Attorneys*	*Fees Paid to Creditor Committee's Attorneys*
Union	0.494**	0.252*	0.615**	0.472*
	(0.203)	(0.134)	(0.246)	(0.274)
Observations	68	68	68	61

Table 4.10

Firm heterogeneity

This table provides RDD results from local linear regressions on the impact of unionization on bond returns for firms with different default risks. Only the coefficients of *Union Victory* are reported. We examine subsamples of firms according to their Z-score (above 3 or below 1.8), Distance-Default (top and bottom quintile), and O-score (below or above 0.5) in the election year, and their credit ratings (investment or speculative grade) in the election month. The dependent variable is bond CAR. We use the optimal bandwidth defined in Imbens and Kalyanaraman (2012) for estimation.

Panel A: Coefficients of Union Victory (Rectangular)

	Distressed				Healthy			
	Z-score	*O-score*	*Distance-to-Default*	*Rating*	*Z-score*	*O-score*	*Distance-to-Default*	*Rating*
CAR (-1, 3)	-0.078***	-0.035	-0.020	-0.062***	-0.009	-0.013	-0.015*	-0.011*
CAR (-1, 6)	-0.094*	-0.139***	-0.012	-0.082**	-0.035*	-0.003	0.007	-0.004
CAR (-1, 9)	-0.130*	-0.204***	-0.059*	-0.121**	-0.031	-0.010	0.002	-0.010
CAR (-1, 12)	-0.150***	-0.239**	-0.075*	-0.152**	-0.035	-0.015	-0.014	-0.018*

Panel B: Coefficients of Union Victory (Triangular)

	Poor				Good			
	Z-score	*O-score*	*Distance-to-Default*	*Rating*	*Z-score*	*O-score*	*Distance-to-Default*	*Rating*
CAR (-1, 3)	-0.075***	-0.048**	-0.020	-0.058**	-0.011	-0.011	-0.008	-0.009
CAR (-1, 6)	-0.088*	-0.135***	-0.008	-0.075**	-0.029	-0.003	0.006	-0.002
CAR (-1, 9)	-0.119*	-0.201***	-0.051	-0.118**	-0.039	-0.013	-0.001	-0.013
CAR (-1, 12)	-0.141***	-0.236**	-0.073*	-0.148**	-0.043	-0.016	-0.016	-0.017

Table 4.11

The role of Right-to-Work (RTW) laws

This table provides results from local linear regressions for subsamples depending on whether the union election takes place in states with or without RTW laws. We examine the impact of unionization on bond returns for each subsample and report the coefficients of *Union Victory* for all event horizons and both subsamples. The dependent variable is bond CAR. We use optimal bandwidth defined in Imbens and Kalyanaraman (2012) for estimation.

Panel A: Coefficients of Union Victory (Rectangular)

	RTW (not passed)		RTW (passed)	
	Unionization Coef.	Std. Err.	Unionization Coef.	Std. Err.
CAR (-1, 3)	-0.022**	(0.009)	-0.025	(0.015)
CAR (-1, 6)	-0.030**	(0.015)	-0.005	(0.021)
CAR (-1, 9)	-0.054**	(0.022)	-0.017	(0.022)
CAR (-1, 12)	-0.067**	(0.028)	-0.018	(0.023)

Panel B: Coefficients of Union Victory (Triangular)

	RTW (not passed)		RTW (passed)	
	Unionization Coef.	Std. Err.	Unionization Coef.	Std. Err.
CAR (-1, 3)	-0.021**	(0.009)	-0.019	(0.015)
CAR (-1, 6)	-0.029**	(0.015)	-0.005	(0.023)
CAR (-1, 9)	-0.055**	(0.023)	-0.013	(0.021)
CAR (-1, 12)	-0.068**	(0.029)	-0.014	(0.023)

Figure 4.1

Occurrence and results of union elections

This figure describes the time series variation in the occurrence and results of union elections in our sample period. The solid line represents the median percentage votes in support of union (% Vote Share for Union) in the elections held in a given year; the dashed line represents the total number of elections (# Elections) held.

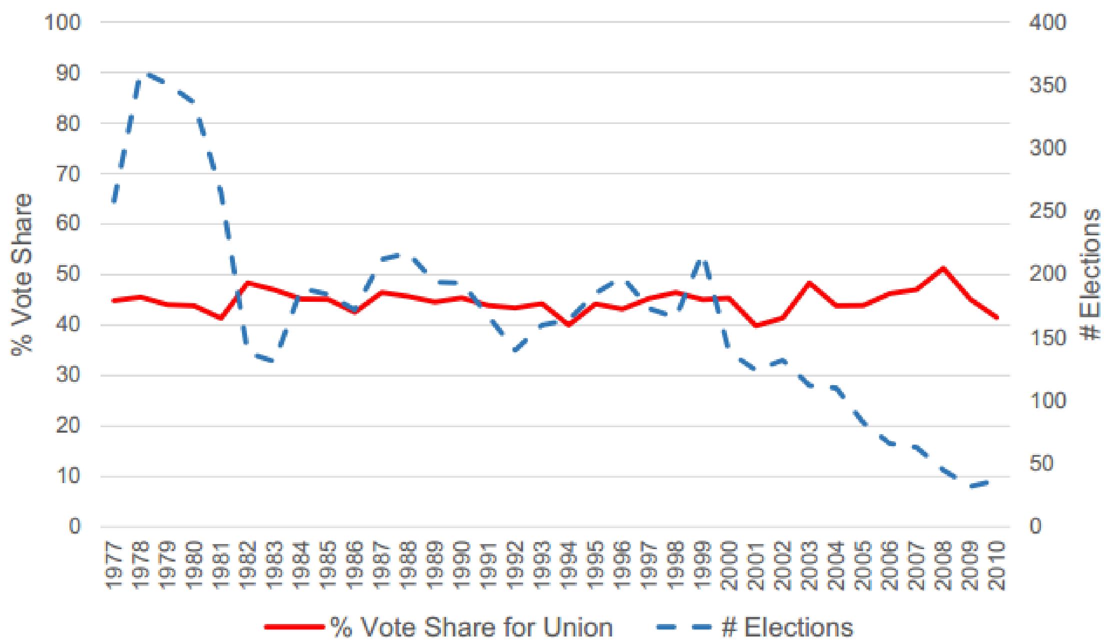


Figure 4.2

Density distribution of the vote share for union

This figure shows the density distribution of vote shares for union following McCrary (2008). The horizontal axis represents the percentage of votes in favor of unionization and the vertical axis represents the associated distribution density. The dots correspond to the observed density. The solid lines show the local linear density estimate of vote share for union (90% confidence intervals are displayed).

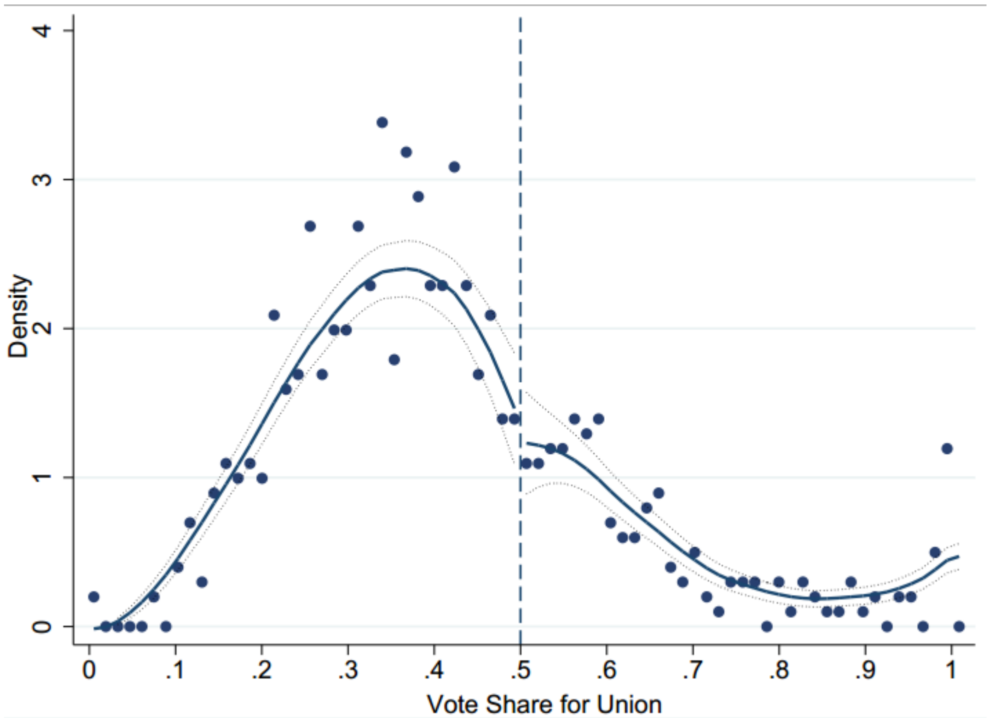


Figure 4.3

Bond CARs following election

This figure shows the bond CARs over 3 months following elections against the vote share for union. The horizontal axis represents the vote share for union, and the vertical axis represents the bond CAR. The dots are CAR conditional means for each bin for union vote share. The solid lines represent the fitted quadratic polynomial function, estimated separately for union loss and union victory cases (below and above 50% vote share). The dotted lines represent the 90% confidence intervals of the polynomial estimation.

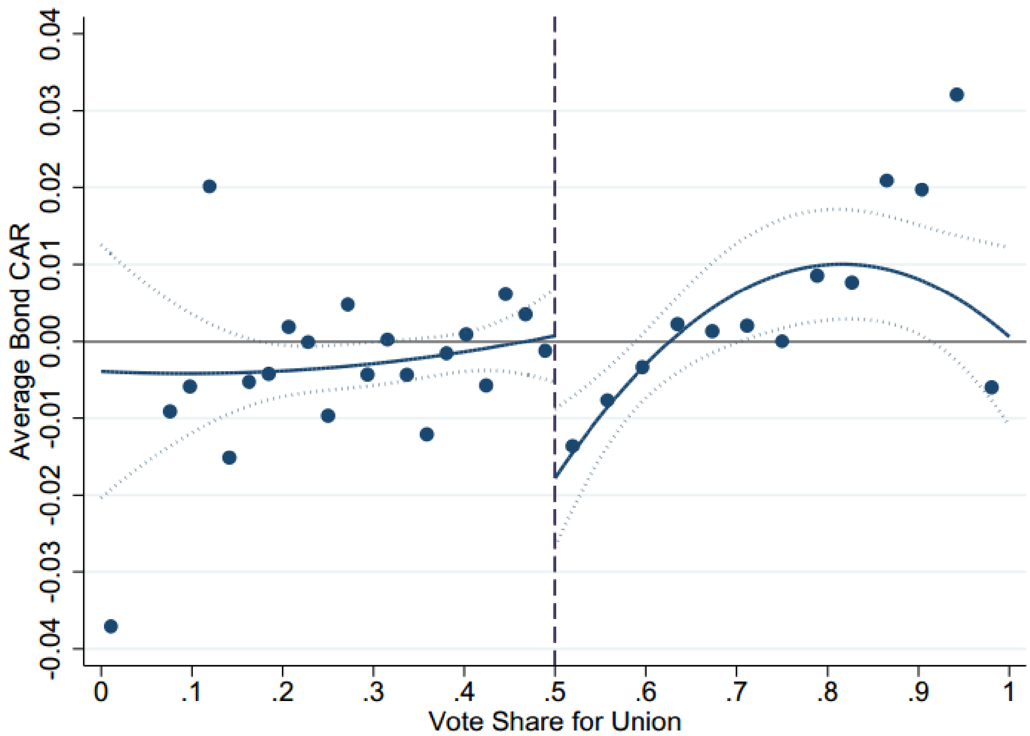


Figure 4.4

Bankruptcy rates following elections

This figure shows the actual 10-year bankruptcy rates for union election winners, losers, and matched firms with no union elections. The red columns represent the subsequent bankruptcy rates following elections for union winners, the blue columns represent the bankruptcy rates for firms without elections.

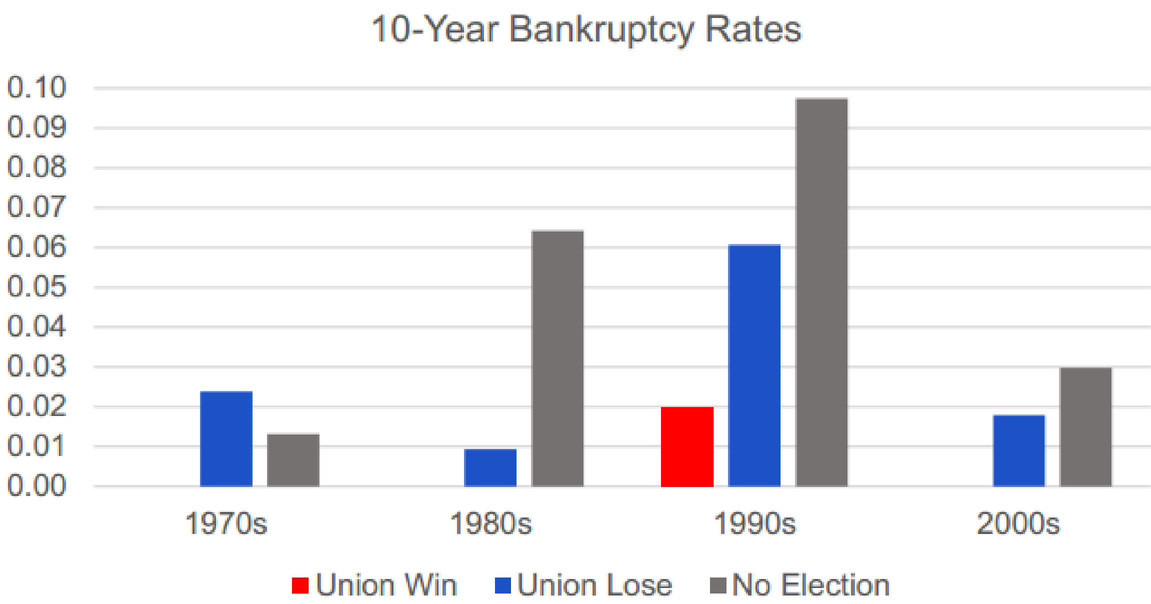


Figure 4.5

Fees and expenses in bankruptcy for unionized and non-unionized firms

This figure shows the fees and expenses paid in bankruptcy by the 10 largest unionized firms (Integrated Health Services, McLeodUSA, Bethlehem Steel Corp., US Airways, Northwest Airlines, Mirant Corp., Adelphia Communications, Delta Air Lines, United Airlines, Worldcom) and 10 largest non-unionized firms (Genuity, SpectraSite Holdings, FLAG Telecom Holdings, Metromedia Fiber Network, Home Holdings, XO Communications, Comdisco, Kmart, Pacific Gas & Electric, Conseco) in our sample. The red hollow dots indicate firms that are unionized, while the blue solid dots indicate firms that are not. Panel (a) shows the fees and expenses paid to attorneys during bankruptcy. Panel (b) shows the fees and expenses paid to financial advisors during bankruptcy. Firms' size before bankruptcy (measured by *ln(Total_Assets*) is shown on the horizontal axis.

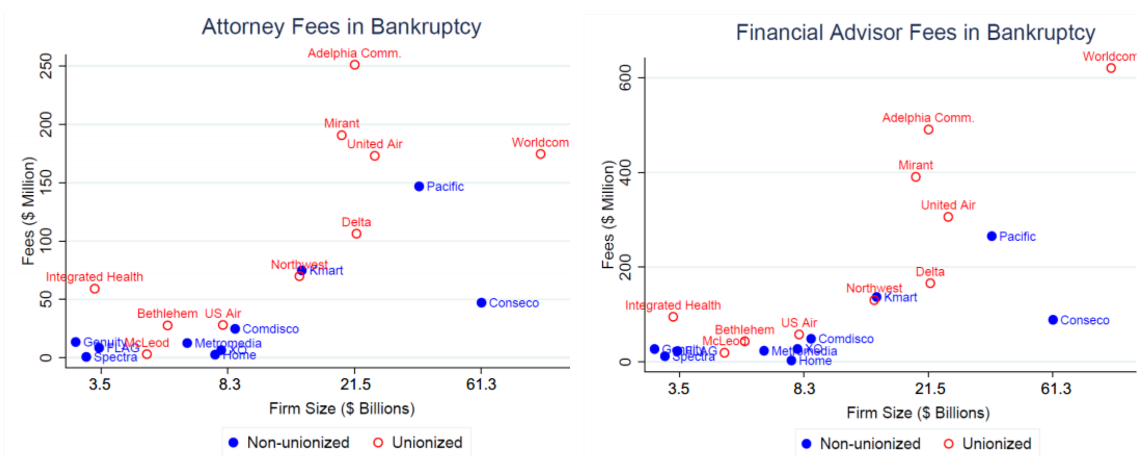
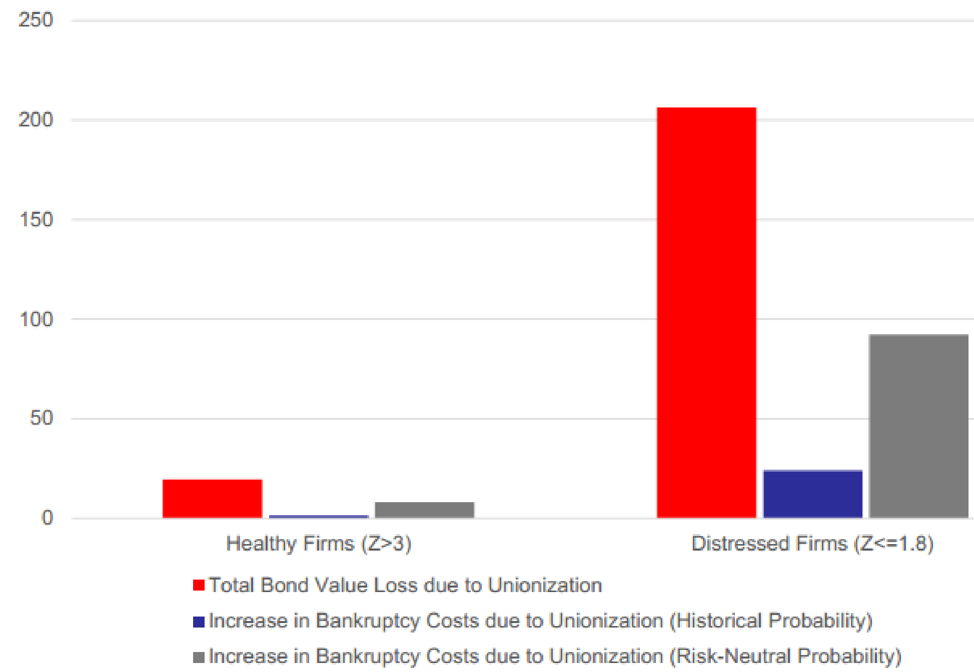


Figure 4.6

Decomposition of value losses to bondholders

This figure analyzes the average value loss to bondholders for firms in different distress categories (in $ millions). The red columns represent the estimated total value loss to bondholders due to unionization in the 12 months following union elections. The blue columns represent the increases in expected bankruptcy costs that are related to unionization, calculated using historical default probabilities. The grey columns represent increases in expected bankruptcy costs calculated with risk-neutral probabilities of default.



Chapter 5 : Conclusions

This thesis includes three essays that study the effects of important events on the financial markets. The first two essays investigate the effects of new financial instruments on existing, related securities. The third essay studies the effects of unionization on the cost of debt and the welfare of creditors. Each of these three essays is self-contained.

The first essay studies how the introduction of GLD, the first bullion-backed ETF, affected the trading characteristics of gold company stocks. GLD holds physical gold as its underlying assets. As a result, it is less information-sensitive than gold company stocks and more appealing to retail/uninformed investors. I find that investors, especially retail investors, migrated from gold company stocks to GLD after it started trading. The migration caused the demand for gold company stocks to decline and their liquidity to deteriorate. For example, the results show that the relative effective bid-ask spreads of gold company stocks increased by more than 15% over the two-month period following GLD's introduction. The results also show that the migration led to a significant increase in the adverse selection cost of trading gold company stocks, as evidenced by an increase in price impact of trades by more than 30%. My robustness tests rule out the possibility that the results were driven by any changes that concurrently occurred in the market and/or the mining industry in the sample period. This essay contributes to the literature on financial innovations. The current literature mainly focuses on how futures contracts and options affect their underlying assets. Few studies have been done on the market impact of other types of financial innovations. This is due to the fact that few financial innovations have been as successful as futures contracts and options, and thus their impact was negligible. As GLD has gained great popularity since its introduction, it provides me with a unique opportunity to test how new financial instruments affect the trading of related securities in a different context. In addition, the essay adds to a growing line of research on commodity securitization. The results indicate that commodity securitization can create competing securities that have negative effects on the demand and liquidity of commodity company stocks.

The second essay furthers the first essay by studying the effect of GLD on the pricing of gold company stocks. Prior literature documents that demand shocks and changes in liquidity can affect asset prices. As the first essay shows that the demand and liquidity of gold company stocks declined after GLD started trading, I further investigate whether the prices of gold company stocks were also affected. To do so, I employ an event-parameter approach to examine the effects of GLD's introduction on the prices of gold company stocks. I find that gold company stocks significantly underperformed the benchmark after GLD's introduction. Next, I examine the dominant reason for the observed negative abnormal returns. The results indicate that the abnormal returns are associated with both the stocks' declining demand and lower liquidity. However, the effect of the negative demand shock played a more dominant role. This essay contributes to the current literature in two major ways. First, it adds to a growing body of literature on commodity securitization, by furthering the understanding of its effect on the pricing and return dynamics of existing, related securities. The results show that commodity securitization can create competing securities that are detrimental to the prices of commodity stocks.

Secondly, the paper provides new evidence that demand curves for stocks slope down and asset prices can be affected by changes in demand.

My third essay studies the effect of unionization on the cost of debt and the welfare of creditors. The relation between workers and creditors is complex. Both workers and creditors hold fixed claims on firms' assets. In good states, actions taken by labor unions to protect workers' interests may also benefit the creditors due to the aligned interests. However, in bad states, labor unions resist employee layoffs and go against efficient liquidation at the cost of creditors. The existing literature mainly focuses on the relation between workers and creditors in good states. This essay tries to study how labor unions affect creditors in insolvent states and investigate the dynamic relation between labor unions and creditors. To this end, I and my co-authors gather data on union elections and examine the price reaction of publicly-traded bonds to union representation elections. We adopt a regression discontinuity design to identify how unionization affects the wealth of bondholders. We find that unionization causes a significant decline in bond value. We further show that the decline is associated with an increase in bankruptcy costs rather than an increase in default probabilities. Specifically, we do not find evidence that unionization leads to poorer firm performance or higher default risk. However, it is associated with prolonged bankruptcy processes, repeated bankruptcy filings, and significantly higher bankruptcy costs, all of which aggravate the losses of bondholders. To our knowledge, this essay is the first study that systematically investigates the effects of organized labors on creditors in insolvent states. It also contributes to the literature on how human capital affects firm financing decisions by showing that the negative relationship between debt ratios and unionization can be partly attributed to the fact that unions are detrimental to unsecured creditors. Altogether, this essay furthers our understanding of the relation between worker organization and corporate investors, an important facet of firm-labor relations.