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**Detecting Informed Trading Activities in the Options
Markets:
Appendix on Subprime Financial Crisis**

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Appendix on Subprime Financial Crisis*

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Detecting Informed Trading Activities in the Options Markets: Appendix on Subprime Financial Crisis

Abstract

This appendix extends the empirical results in Chesney, Crameri, and Mancini (2011). Informed trading activities on put and call options are analyzed for 19 companies in the banking and insurance sectors from January 1996 to September 2009. Our empirical findings suggest that certain events such as the takeovers of AIG and Fannie Mae/Freddie Mac, the collapse of Bear Stearns Corporation and public announcements of large losses/writedowns are preceded by informed trading activities in put and call options. The realized gains amount to several hundreds of millions of dollars. Several cases are discussed in detail.

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1 Introduction

As a result of the Subprime financial and economic crisis, the United States Department of the Treasury announced its voluntary Capital Purchase Program. The program was designed to encourage U.S. financial institutions to increase their capital. The Treasury was willing to purchase up to \$250 billion in senior preferred shares in qualifying U.S. controlled banks and savings associations. Each financial institution was able to obtain a maximum of \$25 billion Tier 1 capital paying an interest rate as high as 5% during the first five years and 9% thereafter. The financial institution willing to participate in the program had to adopt the Treasury Department standards for executive compensation and corporate governance for the period during which the Treasury holds equity issued under the program. An unprecedented volume of the Capital Purchase Program and huge losses/writedowns have seen over 2009–2011. Stocks of many companies have been subject to astonishing ups and downs as well as huge amounts of equity value erased over a remarkably short period of time. Informed traders could have exploited private information concerning default risk and bailout programs before its public release in order to take advantage of those large stock movements.

In this appendix we analyze trading activities in put and call options from January 1996 to September 2009, covering the recent financial crisis. Three different options markets are considered: the Chicago Board Options Exchange (CBOE), with companies American International Group (AIG), Bank of America Corporation (BAC), Bear Stearns Corporation (BSC), Citigroup (C), Fannie Mae (FNM), Freddie Mac (FRE), Goldman Sachs (GS), J.P. Morgan (JPM), Lehman Brothers (LEH), Merrill Lynch (MER), Morgan Stanley (MS), Wachovia Bank (WB) and Wells Fargo Company (WFC); Eurex (Zurich and Frankfurt), with UBS, Credit Suisse Group (CS) and Deutsche Bank (DBK); and Euronext (Paris and London), with Societ e G en erale (GL), HSBC (HSB) and BNP Paribas (BN). Many of the American companies belong to the list of banks which were bailed out receiving approximately \$200 billion through the Capital Purchase Program in an effort to bolster capital and support new lending. The remaining companies have been

severely affected by the financial crisis. Daily returns during the crisis are characterized not only by unusually negative values, but large rises as well. Quarterly results, writedowns, bank run and sold off of stocks easily lead to daily returns of more than $\pm 20\%$. Due to the large positive and negative stock movements, we apply the procedure in Chesney, Crameri, and Mancini (2011) for detecting informed trading activities in put and call options.

2 Data

For completeness, we describe our dataset in this appendix as well. We analyze several American and European companies from the banking and insurance sectors. For American companies, options data are from the Chicago Board Options Exchange (CBOE) as provided by OptionMetrics. Stock prices are downloaded from OptionMetrics as well to avoid non-synchronicity issues, and are adjusted for stock splits and spin-offs using information from the CRSP database. Intraday transaction prices and volumes for each underlying stock price are from the NYSE's Trade and Quote (TAQ) database. This database consists of several millions of records for each stock and is used in the classification of volumes in buyer and seller-initiated trades in order to complete the analysis related to the hedging criterion. For European companies, options data as well as intraday transaction prices and volumes for the underlying stock are obtained from EUREX provided by Deutsche Bank, and from EURONEXT provided by NYSE Euronext. All datasets include the daily cross section of available put and call options for each company and intraday data for the underlying assets from January 1996 to September 2009. We eliminate obvious data errors such as open interest reported at zero for all existing options by excluding those days from our analysis. The list of American and European companies analyzed is given in the Introduction. All options are American style.

3 Empirical Results

We apply the procedure in Chesney, Crameri, and Mancini (2011) to the above-mentioned American and European companies. We use the same notation as in the main paper. We report most of the results in tabular form. Tables 1–13 present an overview of the informed put and call options belonging to the intersection of $\Omega_1 \cap \Omega_2 \cap \Omega_3 \cap \Omega_4$ for the 13 American companies analyzed, Tables 14–16 for the European companies with options listed on EUREX, and Tables 17–19 for the European companies with options listed on EURONEXT. These tables report only the selected transactions during 2007–2009. The total number of detected options for the whole sample period 1996–2009 is given in brackets after the option specification (put or call).

In the following subsections, we separately analyze our empirical findings for the three markets; CBOE, EUREX, and EURONEXT. We discuss some specific cases. Additional tables and figures are available from the authors upon request. Although our sample period covers almost 14 trading years, the percentage of transactions that fall into the Subprime financial crisis (2007–2009) is remarkably high. There may be several reasons for this: first, the high volatility during the crisis induced large and sudden movements in stock prices generating gain opportunities for informed market participants; second, due to the dramatic and rapid collapse of the financial system, the number of corporate and governmental decisions made has sharply increased, giving rise to numerous potential information leakages and informed trading activities; third, trades made before scheduled announcements could be based on speculative bets, the latter being facilitated by several rumors already present in the market. With respect to realized gains, the numbers are generally higher than the ones detected during 1996–2006 and reported in the main paper. By virtue of leverage, large drops/rises in the underlying stock lead relatively quickly to net profits of more than 1 million through option trading. With respect to the option type, we find that the number of detected put trades is usually larger than the number of detected call trades.

3.1 Trading Activities on the CBOE

3.1.1 The Case of American International Group

We start with a concise summary of key events involving AIG, and discuss thereafter our empirical findings. In October 2007, when the stock was at \$68.59, AIG entered a turbulent period. The company reported that its swaps portfolio lost \$352 million. A month later, that figure was revised to \$1.1 billion. Between early October and mid-November 2007, AIG's stock price fell 25%. In February 2008, AIG announced estimated losses of \$11.5 billion, and that it had posted \$5.3 billion in collateral, pushing down the stock to under \$50. In summer 2008, it was reported that the Justice Department was investigating AIG for possible criminal fraud. The UK's Serious Fraud Office would later announce its own probe. At the beginning of September 2008, when the stock was at \$21.96, AIG executives learned that the ratings agencies planned to downgrade the company's rating again. That would trigger more collateral calls, which AIG knew it could not begin to cover. Desperate negotiations to keep the company afloat—including a possible \$75 billion bridge loan from Goldman Sachs and J.P. Morgan, both major counterparties on the credit default swaps—ensued. Tim Geithner, Head of the Federal Reserve Bank of New York, was called in. It became clear that AIG's level of exposure to its credit default swap losses was higher than anyone had yet understood. On September 16th, 2008 the Federal Reserve Board announced that it would take a nearly 80% equity stake in AIG—effectively taking over the firm—and provide an \$85 billion loan. On that day, AIG stock was at \$3.75.

Applying our detection procedure, we selected a total of 17 transactions in put options and 17 in call options for the whole sample period, with 7 and 2, respectively, falling into the financial crisis, January 2007–September 2009. We now discuss some cases in detail. Information regarding the remaining transactions can be found in the reported tables.

The first transaction in put options took place on October 5th, 2007. The underlying stock was at \$69.39. The average return of the underlying stock during the last two trading weeks, M_t , was slightly positive, 0.18%. The requested put options are at-the-money with a value of \$1.9 and

a maturity of November 2007. The increment in open interest is 7,594 contracts, corresponding to 95.7% of its historical distribution. This transaction precedes the first AIG reported losses concerning its business activities in CDS. In the following weeks, the underlying stock fell sharply, increasing the option's value to levels above \$7. Many of these options were sequentially exercised which led to net gains of approximately \$7 million. An interesting sequence of transactions took place in the days leading up to the takeover of AIG on September 16th, 2008. On September 10th, 11th and 12th, large increments in put options were observed on the CBOE. The maturities of these options were October and November 2008. The market was bearish during the preceding trading weeks and a large demand for protective put options seemed to be a plausible consequence. On September 10th the stock traded at \$17.50 and 23,137 new put options with strike \$18 were requested. These options were at-the-money with a price of \$3.40. The following day, the stock traded at \$17.55 and 14,494 new put options with strike \$8 were bought on the CBOE. These options were deep out-of-the-money and therefore quite cheap (\$0.69). Furthermore, on September 12th, 14,249 new out-of-the-money put options with strike \$10 were bought on the CBOE. Their price was \$1.465. The first two options matured in November 2008, whereas the latter matured at the end of September. Three trading days later, on September 16th and just one day after the collapse of Lehman Brothers, the Federal Reserve announced that it would take over AIG. The stock price dropped to \$3.75, pushing those put options deep in-the-money and increasing their value to more than \$14 in the first case, \$5 in the second and third case. On the same day, 12,931 options of the first type, 13,924 of the second and 1,974 of the third were exercised, leading to a net profit of more than \$13 million, \$6 million and \$1 million, respectively. On September 17th and 18th, when the underlying stock decreased further in value to \$2, a large number of these options were exercised, leading to large profits. The total realized gains through exercise, G_t , amounted to \$24, \$4.5 and \$7.9 million, respectively. Figures 1 and 2 report the dynamics of these transactions.

We now discuss a detected transaction in call options which took place on July 30th, 2009. The stock traded at \$13.13 with bearish market condition, with M_t being at -2.21% . 2,806 out-of-the-money (strike \$15) call options were requested on July 30th with a price of \$0.95. A few days later,

on August 7th, a profit quarterly announcement increased the stock value to \$27.14, raising the value of the call options to \$12.38. This represents a net profit of more than 1,200% in less than two trading weeks. On August 28th the stock reached the level of \$50.23, increasing the option's value to \$35. Between July 30th and maturity, i.e. September 2009, exercising the call options led to net gains of more than \$5.5 million. The remaining out-of-the-money call option detected on August 18th, shows similar behavior and the total net gains amounted to \$5.3 million. Additional information can be found in Table 1 and Figure 3.

3.1.2 The Case of Fannie Mae and Freddie Mac

For the case of Fannie Mae, our procedure detected 17 transactions in put options, 10 of which took place in the years 2007–2009, and 13 in call options, 4 of which during the financial crisis. In the case of Freddie Mac, these include 12 for puts and 15 for calls, respectively. 5 trades in puts and 6 in calls occur after 2007.

On July 13th, 2008, after a weekend of negotiations, the Treasury and the Federal Reserve announced emergency measures to backstop Fannie Mae and Freddie Mac. The two companies would get access to credit lines, including direct access to Fed money if necessary, and a provision for the Treasury to take an equity stake in the companies if required. The Securities and Exchange Commission announced measures aimed at stemming the spread of false rumors. Two days later, Fannie Mae and Freddie Mac shareholders still found no overt assurance regarding the fate of common stock in any government bailout. Freddie Mac shares plunged 26% and Fannie Mae plummeted 27%. In the following days, Freddie Mac completed its second successful debt sale of the week, and confidence regarding the fate of the rescue effort moving through Congress rose. Fannie Mae shares rose more than 18% and Freddie Mac added nearly 22%. On July 23rd, the House of Representatives approved a housing market support package including a mandate for the U.S. Treasury to provide equity or debt to Fannie Mae and Freddie Mac. The White House dropped opposition to other measures in the broad housing bill and pledged to sign it into law. Fannie Mae shares rose almost 12% to \$15, their highest close since July 9th. Freddie closed up

more than 11% at \$10.80, its highest close since July 8th. On August 8th, Fannie Mae posted a second quarter loss of \$2.3 billion before preferred dividend payments, or \$2.54 a share. It was the fourth straight quarterly loss, bringing its cumulative loss over 12 months to \$9.44 billion before preferred dividends. Fannie cut its dividend and said it would raise loss reserves. Based on an article published on August 17th in Barron's magazine, the Treasury Department was increasingly likely to recapitalize Fannie Mae and Freddie Mac in the coming months using taxpayer's money. The following day, share prices for mortgage finance companies dropped, with Fannie Mae's price plunging 22% to a 16-year low of \$6.15 and Freddie Mac's down 25% to \$4.39. The New York Times and Washington Post reported late on Friday, September 5th, that in what could be the largest financial bailout in the nation's history, the U.S. government planned to put government sponsored mortgage finance companies Fannie Mae and Freddie Mac under federal control. The closing share price on that Friday was \$7.04 for Fannie Mae and \$5.1 for Freddie Mac. On Sunday, September 7th, 2008 the Federal Government announced its takeover of Fannie Mae and Freddie Mac, effectively nationalizing them. At that point Fannie Mae and Freddie Mac owned or guaranteed about half of the U.S.'s \$12 trillion mortgage market. This led to panic as almost every home mortgage lender and Wall Street bank relied on them to facilitate the mortgage market; investors worldwide owned \$5.2 trillion of debt securities backed by them. On Monday, September 8th, when the market reopened, the stock price of Fannie Mae crashed by almost 90% to under \$1, and Freddie Mac stock fell to \$0.88, decreasing its value by more than 80%.

Our procedure detected a series of informed trades in put options starting on August 11th, the month leading up to the takeover of Fannie Mae and Freddie Mac. 6 large increments in put options were found for the underlying Fannie Mae and one for Freddie Mac. In all cases, the acquired put options were deep out-of-the-money, making them available at a cheap price. On September 7th, when both underlying stocks lost more than 80% of their value, these options went deep in-the-money and, through a sequential exercise in the following days, several millions in net gains were collected. We now discuss a few of these transactions in detail. Additional information for the remaining ones can be found in Tables 5 and 6 and Figures 4 and 5.

For Fannie Mae, on August 11th, 2008 the put option with strike \$6 and maturity September saw an impressive increment in open interest of 10,164 contracts. The underlying stock traded at \$8.40, the market condition M_t was slightly negative (-0.21%) and the put price was \$0.675. Before this strong increment, the level of open interest was almost zero. In the following weeks, the open interest of these options continuously increased, reaching a maximum number of 31,824 contracts on September 4th, where another strong increment of 5,774 contracts was detected by our procedure as an informed trade. On that day, the price of the underlying stock was \$6.42 and the price of the put option \$0.75. On Monday, September 8th, the day after the announcement that the Fed would take over Fannie Mae and Freddie Mac, the value of the put options increased by more than 600%, reaching a value of \$5.3 per option contract. On the same day, 7,162 contracts were exercised, leading to net gains of more than \$3 million. Furthermore, another large number of options (11,730 contracts) were exercised a few days later. The net gains from this exercised amount were more than \$5 million. Another put option informed trade with underlying stock Fannie Mae was detected on August 28th; see Figure 4. The increment in open interest totaled 15,178 contracts, the strike price was \$7 and the option had a time-to-maturity of 114 days. The underlying stock traded at \$7.95 and the put option had a value of \$2.6. Until September 9th, the level of open interest remained constant. The day after, 14,701 contracts were exercised when the option's price was \$6.2. The net gains amounted to more than \$5 million. In the case of Freddie Mac, our methodology detected only one transaction in put options on September 3rd, 2008. Its strike was \$3 with a time-to-maturity of 136 days. The underlying asset traded at \$5.38 and the put had a value of \$0.9. The strong increment in open interest observed on September 3rd (2,260 contracts) was offset by the exercise of 2,430 options on September 10th, when the option had a value of \$2.35. The net gains from this transaction amounted to approximately \$300,000. With respect to the detected transaction in call options, both companies were subject to large trade in calls in March 2008. Our procedure detected 3 informed trades for Fannie Mae on March 5th, 7th and 11th, and three for Freddie Mac on March 10th, 11th and 18th. All these options were almost at-the-money and matured at the end of March. The market condition variable was between -1%

and -2% , indicating that these call options had been bought during a bearish period. We do not provide the details of these transactions but are available upon request. The dynamics behind these trades are the same as those described in the previous examples: the observed increments in open interest are all above their 94% historical quantiles and occurred during the days leading up to March 20th, 2008 when U.S. regulators eased capital requirements for the two firms in order to provide up to \$200 billion in immediate liquidity for stressed mortgage markets. On that day, shares of Fannie Mae and Freddie Mac jumped by approximately 26%. In both cases, a considerable number of call options were exercised in the subsequent days leading to net gains of several millions. Additional details can be found in Tables 5 and 6.

3.1.3 Additional Comments on the CBOE Options Trades

For the remaining companies with options traded on the CBOE, we do not report detailed results but refer to the corresponding tables. We collect a list of option informed trades. The dynamics of these trades are the same as in the previous extensively discussed examples.

For Bank of America, on November 14th, 2008 and January 14th, 2009 two informed trades in put options were detected. Both trades were followed by a stock crash of more than 20% due to the announcements of 35,000 and 1,000 job cuts, respectively. The resulting gains through exercise amounted to \$5.4 million and \$3.3 million, respectively. Quarterly profits announced on July 22nd, 2008 (with a stock value increase of 22.4%), were preceded by a series of transactions in call options resulting in total net gains of more than \$8 million. For Citigroup, our method detected a transaction on Friday, November 21st, 2008 in a deep out-of-the-money call option with short time-to-maturity. The increment in open interest amounted to 61,927 option contracts, i.e. the 99.7% quantile of its historical distribution. On the following Monday, the government's plan to help Citigroup by buying \$20 billion of preferred stock was announced. The stock value increased in the following days by more than 50% and a large number of call options were exercised, leading to net gains of more than \$7 million. The amount of financial losses reported on January 16th, 2009 induced a drop in the underlying stock of more than 23%, and were preceded by 3 transactions

in out-of-the-money put options traded on the CBOE on January 7th, 8th and 12th. The total realized gains after the stock crashed amounted to more than \$9 million. The profit drop of 76% announced by J.P. Morgan on January 15th, 2009 was preceded by three large trades in put options on December 31st, January 2nd and 6th. Realized gains totaled more than \$17 million. The strong rise in stock value between March 9th and March 18th (from \$15.9 to \$27.11) was preceded by unusually high increments in out-of-the-money call options between March 5th and 9th. Realized gains from options exercise totaled more than \$16 million. For Morgan Stanley, we found 2 large transactions in deep out-of-the-money call options on October 9th and 10th, 2008. These precede the announcement on Monday, October 13 that a Japanese bank intended to buy 1/5 of Morgan Stanley. The stock value nearly doubled that day, resulting in net gains of more than \$12 million through the exercise of those call options. A series of informed trades in put options with underlying stock in Wachovia Bank was detected during the month of September 2008, the period leading up to the announcement on September 29th that the bank would be taken over due to its uncertain situation. On that day, the stock plummeted by more than 81%, pushing these put options deep in-the-money. The subsequent exercise of these options led to realized gains of more than \$23 million. For Wells Fargo, the underlying stock had been sharply losing value during the first two months of 2009: the stock was traded around \$30 in January 2009, and on February 27th, it was worth \$12.1. We detected informed trades on January 6th, 7th, 8th and 28th. The subsequent exercise of these put options led to substantial gains.

3.2 Trading Activities on EUREX—Frankfurt and Zurich

Option contracts with underlying German and Swiss companies are traded on EUREX, one of the world's largest derivatives exchanges and the leading clearing house in Europe established in 1998 after the merger between Deutsche Terminbörse (DTB, the German derivatives exchange) and SOFFEX (Swiss Options and Financial Futures). In this section we use the EUREX database provided by Deutsche Bank to analyze option transactions with underlying UBS, Credit Suisse Group (CS) and Deutsche Bank (DBK). Our empirical findings are summarized in Tables 14, 15

and 16. In the case of UBS, our procedure detected 16 transactions in put options, 13 of which fell into the period 2007–2009. The proportion of call options is smaller, with 3 out of 13 transactions taking place during the financial crisis. For CS, we detected 16 trades in puts and 13 trades in calls for the entire sample period. The proportion falling into the period after 2007 is around one third. For DBK, we identified a total of 16 transactions in put and 3 in call options. More than half of these put trades took place in the last two years of our sample, whereas only one call informed trade was found for the years 2007–2009.

We now discuss a specific event related to Credit Suisse. On October 13th, 2008 Israeli holding company Koor Industries (KOR.TA) invested CHF 1.2 billion in Credit Suisse in exchange for a 3% stake in the bank. On that day, CS jumped by more than 27%. Furthermore, on October 16th, 2008 Credit Suisse raised approximately CHF 10 billion, about 12% of its outstanding equity, from private investors. The Qatar Investment Company increased its stake in Credit Suisse to 8.9%, while Saudi conglomerate Olayan increased its stake to 3.6%. Our procedure detected an informed trade on September 18th in deep out-of-the-money call options with maturity December 2008. The increment in open interest amounted to 10,010 contracts, being at the 93% quantile of its historical distribution. Due to the remarkable rise in stock value observed a few weeks later, these options went in-the-money and saw gains through exercise of approximately CHF 1.5 million.

3.3 Trading Activities on EURONEXT—London and Paris

Options with underlying French and British companies are traded on EURONEXT in Paris and London. In this subsection we report our empirical findings for Societ  G n rale (GL), BNP Paribas (BN) and HSBC (HSB). We discuss some specific cases. Information regarding the remaining transactions can be found in Tables 17–19.

3.3.1 The Case of Societ  G n rale

On January 24th, 2008 the bank announced that a single futures trader at Societ  G n rale had fraudulently lost the bank  4.9 billion, the largest such loss in history. J rome Kerviel, a relatively

junior futures trader, allegedly orchestrated a series of bogus transactions that spiraled out of control amid turbulent markets in 2007 and early 2008. Executives said the trader acted alone and that he may not have benefited directly from the fraudulent deals. The bank announced it would be immediately seeking €5.5 billion Euros in financing. On Tuesday, January 22nd, 2008 the French stock market regulator said that it had begun a formal investigation into Société Générale. It was not clear whether the inquiry was related to the revelation that Robert Day, a member of Société Générale's Board, had sold shares in the bank worth €45 million on January 18th, the day Société Générale explained that management had first been alerted to Mr. Kerviel's unauthorized trading, and two days before the bank's audit committee was informed of a planned €2.05 billion writedown linked to the bank's exposure to the U.S. Subprime lending market. Société Générale and a spokesman for Mr. Day said in separate statements that the share sales by Mr. Day and his family's trusts occurred in several transactions from December 2007 to January 18th, 2008 during a predetermined window when directors were allowed to exercise options. Both statements said all required disclosures had been made, and "no inside information was used in any way" with respect to these sales. Our detection procedure detected two informed trades in put options on January 9th and 16th, 2008. Both options were out-of-the-money with short maturity. Their exercise led to gains of more than €1.7 million. In addition, the February 12th, 2008 announcement that Société Générale planned to raise \$8 billion in capital was preceded by two informed trades in deep-out-of-the money call options. After the substantial stock rise, the exercise of these options led to a total gain of more than €9 million. Other informed trades in put as well as call options can be found in Table 17.

3.3.2 Additional Comments on EURONEXT Options Trades

For BNP Paribas and HSBC we do not report detailed results but refer to the corresponding tables for additional information (Tables 18 and 19). For BNP Paribas, we detected a series of informed trades which took place between January 14th and 18th, 2008. The involved put options were deep out-of-the-money with short maturity. On January 30th, the announcement that quarterly profit

would slump over 40% had a strong impact on the underlying asset. The exercise of these put options led to a net profit of more than €2 million.

3.4 Controlling False Discoveries in Option Informed Trades

We apply the procedure described in Chesney, Crameri, and Mancini (2011) to control for false discoveries in informed trades. We briefly discuss the results Lehman Brothers. For the remaining companies, similar results have been found. Details are available upon request from the authors. The total number of analyzed options trades amounts at 218,000, implying that the regression coefficients δ_m for the subintervals I_m have been computed by relying on 218 returns r_t^k . The estimated proportion of truly informed traders is $E[T^+] = 6.9\%$ (with standard error 0.9%, optimal $\lambda = 0.6$, and $\gamma = 0.05$), corresponding to 69 informed traders. As our method detected 7 option informed trades, it appears to be conservative. Figure 7 shows estimated δ_m , t -statistics, and p-values for computing the false discovery rate for Lehman Brothers.

4 Conclusions

This appendix extends the empirical results in Chesney, Crameri, and Mancini (2011) and analyzes call and put options trades on several financial institutions from January 1996 to September 2009, covering the Subprime financial crisis. We find that the detected option trades are not uniformly distributed over our sample period (1996–2009), but that the great majority falls into the period 2007–2009. Our empirical findings suggest that periods leading up to certain events such as the takeovers of AIG, Fannie Mae/Freddie Mac, the collapse of Bear Stearns Corporation and public announcements relating to large losses/writedowns are preceded by informed trading activities in options. Realized gains amount to several hundreds of millions of dollars.

References

Chesney, M., R. Crameri, and L. Mancini, 2011, “Detecting Informed Trading Activities in the Options Markets,” Working paper, University of Zurich.

Content of Tables: day on which the transaction took place, Day; market condition at day t measured by the average return of the underlying stock during the last two trading weeks, M_t ; option strike K ; option price, P_t ; stock value, S_t ; its time-to-maturity, τ ; increment in open interest from day $t - 1$ to day t , ΔOI_t ; its quantile with respect to its empirical distribution computed over the last two years, q_t ; corresponding volume, V_t ; maximum for calls and minimum for puts return realized by the underlying stock during the two-week period following the transaction day, r_t^s ; number of days between transaction day t and when this maximum return occurs, τ_1 ; maximum return realized by the selected option during the two-week period following the transaction day, r_t^o ; number of days between transaction day t and when this maximum return occurs, τ_2 ; gains realized through the exercise of the new option issued at time t , G_t ; short description of the event and why the stock drops, Event's description. Number in bracket after Put options or Call options denotes the number of detected option informed trades for our whole sample period, January 1996 – September 2009.

American International Group (AIG)														
Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (17)														
05 Oct 07	0.18%	70	1.90	69.39	43	7594	95.70%	9572	-3.21%	17	181.58%	10	6,948,700	CDS loss \$1.1 billion
26 Feb 08	-0.64%	50	1.73	51.42	25	18091	98.30%	26703	-6.56%	6	375.36%	10	6,621,600	10 Mar: \$7.8 billion loss
07 May 08	0.22%	43	1.29	45.08	10	15073	97.70%	23615	-8.77%	5	258.53%	4	3,282,600	8 May: Quarterly Loss
08 Aug 08	0.68%	20	0.66	24.87	43	16951	97.30%	33507	-18.05%	2	221.97%	10	10,386,000	5 Aug: Quarterly Loss
10 Sep 08	-0.23%	18	3.40	17.50	38	23137	98.30%	28252	-60.79%	6	367.65%	6	24,712,000	16 Sept: Fed lends \$85 bln to AIG
11 Sep 08	-0.35%	8	0.69	17.55	37	14494	95.10%	15335	-60.79%	5	693.48%	5	4,532,100	16 Sept: Fed lends \$85 bln to AIG
12 Sep 08	-1.24%	10	1.47	12.14	8	14249	94.90%	52077	-60.79%	4	440.96%	4	7,910,900	16 Sept: Fed lends \$85 bln to AIG
Call Options (17)														
30 Jul 09	-2.21%	15	0.95	13.13	51	2806	64.70%	2808	62.72%	7	1352.40%	8	5,536,000	7 Aug: Quarterly profit
18 Aug 09	4.25%	31	1.21	24.55	32	3223	70.70%	2925	26.93%	10	1539.00%	9	5,268,100	

Table 1: Summary of detected informed trades for American International Group. For definition of entries see Page 18.

Bank of America Corporation (BAC)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (16)														
19 Jun 08	-0.86%	30	3.35	28.14	58	27151	99.50%	32226	-8.09%	20	126.87%	10	8,872,400	
14 Nov 08	-1.57%	15	0.59	16.42	8	21136	97.30%	34814	-20.92%	13	541.03%	5	5,410,400	11 Dec: cut of 35,000 jobs
14 Jan 09	-1.15%	10	0.39	10.20	3	15774	94.50%	36500	-28.97%	6	628.21%	3	3,325,600	21 Jan: cut of 1,000 jobs
07 May 09	2.23%	13	0.66	13.51	9	35313	97.30%	102930	-10.20%	7	167.94%	7	2,002,100	5 Mai: needs \$33.9 billion
Call Options (20)														
22 Jan 08	-0.36%	40	0.53	37.39	25 3	12606	98.30%	22114	8.50%	4	900.00%	9	2,383,700	24 Jan: 6 bln new shares
08 Jul 08	-1.70%	30	0.90	23.54	193	10641	95.50%	12181	22.41%	9	244.44%	10	1,900,100	22 Jul: Quarterly profit
09 Jul 08	-1.73%	23	0.93	22.06	10	10076	94.30%	14985	22.41%	8	435.14%	8	3,994,300	22 Jul: Quarterly profit
10 Jul 08	-1.69%	25	1.81	22.36	135	8486	92.10%	13883	22.41%	7	417.96%	10	1,549,400	22 Jul: Quarterly profit
15 Jul 08	-1.20%	28	0.50	21.67	130	5044	80.30%	5761	22.41%	4	1400.00%	7	1,070,500	22 Jul: Quarterly profit
15 Sep 08	0.30%	30	0.57	26.55	5	11070	94.70%	39933	22.56%	7	935.40%	5	7,654,900	15 Sep: BAC acquires MER
06 Mar 09	-1.64%	4	0.24	3.14	15	26877	97.50%	49783	27.73%	5	1442.60%	9	3,337,100	10 Mar: Surprising Value
11 Mar 09	-1.35%	7	0.43	4.93	38	31482	97.70%	41024	27.73%	2	276.74%	9	7,809,700	10 Mar: Surprising Value
23 Apr 09	2.12%	11	0.45	8.82	23	85737	99.70%	134900	19.31%	10	353.93%	10	9,796,900	8 May: Find Ready Investors
28 Apr 09	1.38%	11	0.23	8.15	18	58619	99.50%	101270	19.31%	7	1344.40%	9	5,719,800	8 May: Find Ready Investors
29 Apr 09	1.61%	10	1.06	8.68	52	35473	97.10%	44553	19.31%	6	338.39%	8	9,254,600	8 May: Find Ready Investors
04 May 09	1.80%	10	1.91	10.38	47	35626	97.10%	46098	19.31%	3	142.78%	5	6,789,800	8 May: Find Ready Investors
05 May 09	1.78%	13	0.41	10.84	11	33455	96.50%	91088	19.31%	2	374.07%	4	2,024,000	8 May: Find Ready Investors
23 Jul 09	-0.31%	13	0.50	12.69	30	50593	97.90%	82085	6.72%	18	635.00%	10	5,314,400	

Table 2: Summary of detected informed trades for Bank of America Corporation. For definition of entries see Page 18.

Bear Stearns Corporation (BSC)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (16)														
05 Oct 07	0.64%	115	1.53	131.58	43	1776	87.10%	2231	-3.75%	4	129.51%	7	2,081,900	
09 Oct 07	0.89%	125	2.53	127.46	11	5692	99.70%	7061	-5.35%	21	220.79%	9	2,085,500	
10 Dec 07	-0.43%	105	3.80	105.75	12	3713	96.10%	5529	-5.92%	20	301.32%	10	2'312'700	
04 Mar 08	-0.19%	70	1.65	77.17	18	2570	89.70%	3374	-83.97%	12	3854.50%	10	12,086,000	15 Mar: bank run
10 Mar 08	-0.60%	30	0.63	62.30	12	11757	99.70%	16260	-83.97%	8	3948.00%	6	28,484,000	15 Mar: bank run
11 Mar 08	-0.76%	30	0.25	62.97	11	22809	99.90%	57893	-83.97%	7	10020.00%	5	55'246'000	15 Mar: bank run
12 Mar 08	-0.79%	40	1.88	61.58	38	4156	96.10%	6210	-83.97%	6	1782.70%	4	6,013,800	15 Mar: bank run
13 Mar 08	-1.21%	25	0.28	57.00	9	26219	99.90%	39624	-83.97%	5	7281.80%	3	49,898,000	15 Mar: bank run
14 Mar 08	-1.10%	20	2.78	30.00	8	25246	99.70%	48910	-83.97%	4	451.35%	2	28,450,000	15 Mar: bank run
Call Options (11)														
07 Sep 07	0.09%	110	3.85	105.37	15	4791	99.10%	6245	7.67%	16	159.74%	8	1,413,400	
20 Mar 08	-8.34%	8	1.08	5.96	30	6485	98.10%	9653	88.76%	4	262.79%	2	1,667,400	

Table 3: Summary of detected informed trades for Bear Stearns Corporation. For definition of entries see Page 18.

Citigroup (C)														
Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^S	τ_1	r_t^O	τ_2	G_t	Event's description
Put Options (14)														
07 Jan 09	-0.32%	5	0.36	7.15	73	13329	80.50%	13071	-23.22%	8	588.89%	9	1,476,000	16 Jan: Report Big Loss
08 Jan 09	-0.09%	6	0.57	7.16	72	24515	93.90%	27180	-23.22%	7	487.72%	8	4,534,800	16 Jan: Report Big Loss
12 Jan 09	-0.73%	5	0.60	5.60	40	25233	94.90%	40328	-23.22%	5	296.64%	6	3,020,000	16 Jan: Report Big Loss
Call Options (24)														
22 Jan 08	-0.77%	25	0.98	24.40	25	29208	99.30%	59560	8.03%	4	392.31%	9	4,484,700	
21 Nov 08	-2.41%	5	0.92	3.77	29	61927	99.70%	101750	57.83%	4	277.72%	5	7,566,600	23 Nov: cash infusion from U.S
08 Apr 09	5.99%	2	0.73	2.70	38	25031	91.10%	36978	25.00%	5	193.10%	4	2,964,100	
30 Jul 09	-0.51%	3	0.24	3.14	23	216040	99.70%	464560	10.41%	1	310.64%	8	4,327,500	

Table 4: Summary of detected informed trades for Citigroup. For definition of entries see Page 18.

Fannie Mae (FNM)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (17)														
08 Nov 07	-1.24%	45	2.40	49.80	44	1993	91.90%	2196	-24.83%	11	606.25%	9	2,048,600	10 Nov: Third-Quarter Loss
09 Nov 07	-0.91%	40	1.28	49.00	43	3878	96.90%	5642	-24.83%	10	864.71%	8	1,792,500	10 Nov: Third-Quarter Loss
20 Jun 08	-0.74%	21	1.18	23.81	29	2519	81.70%	2693	-27.34%	19	148.94%	10	1,640,700	10 Jul: U.S. mulls future of FNM
07 Jul 08	-1.46%	18	4.55	15.74	75	6262	95.50%	10163	-27.34%	9	140.66%	7	1,096,100	7 Jul: U.S. mulls future of FNM
11 Aug 08	-0.21%	6	0.68	8.40	40	10164	99.10%	10657	-26.79%	10	262.96%	8	3,442,900	
13 Aug 08	0.43%	3	0.45	7.69	157	9603	97.70%	9653	-89.63%	20	150.00%	6	1,177,600	20 Aug: fear of potential losses
27 Aug 08	-3.48%	3	0.43	6.48	52	7752	95.90%	11376	-89.63%	10	335.29%	8	733,000	5 Sept: under federal control
28 Aug 08	-2.75%	7	2.60	7.95	114	15178	99.50%	15240	-89.63%	9	142.31%	7	5,541,700	5 Sept: under federal control
29 Aug 08	-2.97%	3	0.40	6.84	50	5582	91.90%	6610	-89.63%	8	362.50%	6	619,600	5 Sept: under federal control
04 Sep 08	-1.88%	6	0.75	6.42	16	5774	92.10%	7041	-89.63%	5	640.00%	10	2,609,800	5 Sept: under federal control
Call Options (13)														
20 Nov 07	-1.63%	30	3.00	28.25	32	3622	96.90%	7832	18.62%	10	200.00%	8	1,432,700	7 Dec: Raise Capital
05 Mar 08	-0.94%	26	1.03	24.27	17	10333	99.70%	6006	27.06%	12	163.41%	10	3,001,600	20 Mar: reduction cushion of capital
07 Mar 08	-1.51%	24	1.13	22.77	15	3580	94.30%	2992	27.06%	10	811.11%	10	842,200	20 Mar: reduction cushion of capital
11 Mar 08	-1.75%	23	1.53	22.00	11	5192	97.30%	8494	27.06%	8	670.49%	8	4,251,400	20 Mar: reduction cushion of capital

Table 5: Summary of detected informed trades for Fannie Mae. For definition of entries see Page 18.

Freddie Mac (FRE)														
Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (12)														
20 Jun 08	-0.66%	24	3.15	21.82	29	2937	89.30%	3071	-26.02%	19	201.59%	10	3,318,600	7 Jul: plunge on capital concerns
03 Jul 08	-1.96%	15	1.60	14.50	16	5116	94.70%	6252	-26.02%	10	500.00%	8	2,674,500	15 Jul: rescue plan does not convince
07 Jul 08	-1.97%	13	1.90	11.91	12	9983	97.70%	12005	-26.02%	9	273.68%	7	4,009,700	15 Jul: rescue plan does not convince
09 Jul 08	-2.66%	10	1.25	10.26	10	12875	98.50%	24356	-26.02%	7	280.00%	5	984,260	15 Jul: rescue plan does not convince
03 Sep 08	-1.36%	3	0.90	5.38	136	2260	79.90%	2686	-82.75%	6	211.11%	10	320,760	7 Sept: government's takeover of FRE, FNM
Call Options (15)														
20 Nov 07	-1.24%	30	1.98	26.74	32	6159	99.90%	9854	18.84%	10	188.61%	8	187,320	20 Nov: third quarter \$2 bln loss
23 Nov 07	-1.60%	25	3.60	26.47	29	2592	97.70%	3275	18.84%	8	234.72%	10	232,670	20 Nov: third quarter \$2 bln loss
27 Nov 07	-3.01%	25	2.65	25.73	25	4318	99.70%	4945	18.84%	6	354.72%	8	1,367,300	28 Nov: Cuts Dividend in Half
10 Mar 08	-1.62%	20	0.55	17.39	12	2990	95.30%	4691	26.19%	9	2218.20%	9	668,520	5 Mar: Fed consider rescue
11 Mar 08	-1.77%	20	1.48	20.16	11	3394	96.50%	6886	26.19%	8	764.41%	8	575,570	11 Mar: Carlyle fund liquidation
18 Mar 08	-1.41%	25	1.55	26.02	4	3479	96.30%	11493	26.19%	3	396.77%	3	1,569,600	20 Mar: reduction cushion of capital

Table 6: Summary of detected informed trades for Freddie Mac. For definition of entries see Page 18.

Goldman Sachs (GS)														
Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (13)														
20 Feb 07	0.35%	220	5.05	220.94	25	6162	99.50%	7953	-4.21%	14	490.10%	10	9,286,700	
20 Jul 07	0.20%	200	5.20	205.94	29	4048	95.30%	8594	-2.53%	13	168.27%	10	2,372,800	19 Jul: deal for 2nd Jersey City Tower
25 Jul 07	0.39%	185	1.15	203.16	24	7434	99.50%	12329	-2.53%	10	708.70%	8	5,531,800	1 Jul: deal for 2nd Jersey City Tower
Call Options (15)														
17 Mar 08	-0.01%	170	0.85	151.02	5	4089	94.50%	11055	3.42%	13	970.59%	4	1,560,800	18 Mar: beat expectations earnings
11 Jun 08	-1.12%	170	3.90	162.40	10	11406	99.30%	20313	16.27%	11	330.77%	7	8,896,900	
16 Jul 08	0.67%	170	4.45	172.86	3	4685	95.50%	19103	5.26%	13	184.27%	3	3,419,000	
10 Mar 09	-0.98%	105	2.71	85.28	39	4014	92.70%	7132	14.35%	14	375.05%	10	1,286,800	

Table 7: Summary of detected informed trades for Goldman Sachs. For definition of entries see Page 18.

J.P. Morgan (JPM)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (20)														
20 Jul 07	-0.04%	48	1.40	47.56	29	5128	93.90%	8345	-5.03%	17	175.00%	5	1,039,200	
01 Feb 08	0.54%	48	1.08	48.25	15	11340	98.10%	12911	-5.04%	5	365.12%	10	3,452,900	
31 Dec 08	0.13%	30	2.37	31.53	52	2852	60.10%	2859	-20.73%	15	158.44%	8	890,540	15 Jan: profit drops 76%
02 Jan 09	-0.04%	32	3.25	31.35	50	6953	88.10%	8218	-20.73%	14	143.08%	10	4,040,000	15 Jan: profit drops 76%
06 Jan 09	0.66%	30	4.08	29.88	74	40772	99.30%	43454	-20.73%	12	201.23%	10	12,084,000	15 Jan: profit drops 76%
11 Feb 09	0.47%	26	3.01	26.09	38	8368	88.70%	10789	-13.99%	18	132.95%	8	1,272,400	
Call Options (12)														
23 Sep 08	0.60%	43	2.30	40.56	25	8433	93.50%	10800	16.75%	1	258.39%	8	2,061,700	
05 Mar 09	-0.76%	18	1.46	16.60	16	9604	93.10%	16918	24.67%	15	566.67%	10	1,393,400	
06 Mar 09	-0.73%	21	1.22	15.93	43	10656	94.90%	19395	24.67%	14	481.97%	9	6,178,200	16 Apr: anticipating profits
09 Mar 09	-0.91%	18	1.94	15.90	40	10000	93.50%	10338	24.67%	13	401.29%	8	8,694,100	16 Apr: anticipating profits

Table 8: Summary of detected informed trades for J.P. Morgan. For definition of entries see Page 18.

Lehman Brothers (LEH)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (8)														
29 Feb 08	-0.28%	50	2.68	50.99	22	15279	99.10%	27054	-19.13%	14	182.24%	7	2,243,500	28 Mar: investors sold off stocks
13 Mar 08	-1.61%	50	6.15	45.99	37	13431	98.50%	15704	-19.13%	5	219.51%	3	12,680,000	28 Mar: investors sold off stocks
15 May 08	0.69%	45	3.18	44.77	37	5374	84.90%	5825	-13.64%	21	193.70%	7	4,055,300	10 Jun: Loss of 3 billion
16 May 08	0.46%	41	1.99	43.64	36	10905	96.10%	11537	-13.64%	20	207.79%	6	6,332,300	10 Jun: Loss of 3 billion
21 May 08	-0.15%	35	1.65	39.56	31	9234	94.30%	16594	-13.64%	17	266.67%	9	4,808,800	10 Jun: Loss of 3 billion
Call Options (12)														
17 Mar 08	-1.05%	35	3.08	31.75	5	8836	99.50%	22144	46.43%	4	343.90%	4	8,450,400	19 Mar: earnings
15 Jul 08	-1.31%	15	0.68	13.22	4	16938	99.30%	41781	25.95%	4	503.70%	4	5,731,200	17 Jul: biggest one-day rally

Table 9: Summary of detected informed trades for Lehman Brothers. For definition of entries see Page 18.

Merrill Lynch (MER)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^S	τ_1	r_t^O	τ_2	G_t	Event's description
Put Options (15)														
18 Jun 07	-0.09%	90	2.30	90.00	33	5532	96.90%	6221	-3.54%	18	195.65%	10	1,990,500	20 Jun: hedge funds losses
10 Oct 07	0.25%	70	1.50	74.94	38	2362	79.50%	2593	-7.90%	20	273.33%	8	1,040,700	5 Oct: \$5.5 billion loss
23 Oct 07	-0.34%	63	1.60	67.12	25	9120	98.90%	15002	-7.90%	11	343.75%	10	1,827,300	24 Oct: biggest quarterly loss
11 Jan 08	-1.19%	55	2.18	54.69	8	7375	95.70%	12695	-10.24%	7	152.87%	5	1,021,300	15 Jan: 21 bln infusion
02 Jun 08	-0.61%	43	1.93	42.62	19	10060	95.50%	19021	-6.80%	21	268.83%	8	2,614,200	2 Jun: ratings cut by S&P
03 Sep 08	0.25%	23	0.19	28.33	17	14031	94.70%	18682	-19.59%	21	3018.40%	8	1,847,900	15 Sept: BAC acquires Merrill
Call Options (17)														
14 Jul 08	-1.13%	25	3.60	25.88	33	9133	97.50%	5413	13.41%	5	151.39%	8	618,760	Raise Capital
15 Jul 08	-0.97%	25	4.03	24.69	95	5408	92.30%	6169	13.41%	4	144.10%	7	779,060	Raise Capital

Table 10: Summary of detected informed trades for Merrill Lynch. For definition of entries see Page 18.

Morgan Stanley (MS)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (21)														
21 Jun 07	0.21%	85	1.25	87.29	30	7347	98.90%	10368	-14.96%	10	130.00%	4	6,868,600	22 Jun: Blackstone Rival Plans Own I.P.O
26 Oct 07	0.20%	60	2.20	64.78	57	4570	96.10%	6601	-7.20%	7	338.64%	9	1,523,000	7 Nov: Write-Down Expected
30 Oct 07	-0.18%	65	3.70	65.49	53	3045	92.70%	3207	-7.20%	5	277.03%	7	2,333,900	7 Nov: Write-Down Expected
31 Oct 07	0.16%	65	2.88	67.26	52	8100	98.50%	11093	-7.20%	4	385.22%	6	9,177,000	7 Nov: Write-Down Expected
15 May 08	0.55%	45	1.35	47.71	37	8745	96.70%	9126	-8.48%	18	211.11%	7	3,535,000	2 Jun: ratings cut by S&P
16 May 08	0.38%	45	1.53	47.21	36	4877	91.10%	4978	-8.48%	17	175.41%	6	1,527,300	2 Jun: ratings cut by S&P
05 Jun 08	-0.75%	43	2.35	44.59	44	12093	98.90%	12614	-8.48%	4	191.49%	5	3,856,400	2 Jun: ratings cut by S&P
04 Sep 08	0.02%	37	0.95	40.34	16	10713	96.50%	12073	-24.22%	12	1568.40%	10	8,582,700	18 Sept: plan to merger with Wachovia
05 Sep 08	0.03%	36	1.30	41.36	43	1250	45.90%	1251	-24.22%	11	1157.70%	9	1,451,100	18 Sept: plan to merger with Wachovia
15 Sep 08	-0.39%	30	3.75	32.19	33	10704	96.30%	20113	-25.89%	21	216.00%	3	1,920,200	18 Sept: plan to merger with Wachovia
Call Options (19)														
13 Mar 08	-0.57%	45	1.40	41.60	37	13151	99.90%	21130	17.81%	6	342.86%	6	1,324,500	19 Mar: profits
17 Mar 08	-0.14%	40	1.00	36.38	5	4122	95.10%	8154	17.81%	4	895.00%	4	2,893,900	20 Mar: profits
09 Oct 08	-2.50%	18	1.33	12.45	9	26507	99.30%	7920	86.98%	5	254.72%	4	3,311,900	13 Oct: sell 1/5 to a big Japanese bank
10 Oct 08	-3.41%	10	2.75	9.68	8	10675	98.10%	23102	86.98%	4	336.36%	3	8,553,700	13 Oct: sell 1/5 to a big Japanese bank

Table 11: Summary of detected informed trades for Morgan Stanley. For definition of entries see Page 18.

Wachovia Bank (WB)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (12)														
01 Feb 08	0.05%	38	0.98	38.76	15	12383	99.10%	19142	-8.33%	4	305.13%	10	2,317,400	
27 May 08	-0.06%	25	2.10	24.77	53	8872	95.30%	12472	-6.76%	11	197.62%	10	679,660	
03 Jun 08	-0.92%	20	0.55	21.92	18	14629	98.70%	25778	-6.76%	6	286.36%	9	2,220,700	
08 Sep 08	-0.38%	19	1.20	18.99	12	15420	96.90%	18341	-81.60%	18	729.17%	8	4,325,800	29 Sep: taken over of Wachovia
09 Sep 08	-0.69%	16	1.15	16.24	11	20643	97.90%	24149	-81.60%	17	504.35%	7	20,656	29 Sep: taken over of Wachovia
16 Sep 08	0.04%	8	1.45	11.51	32	12138	93.90%	19833	-81.60%	12	293.10%	10	2,900,300	29 Sep: taken over of Wachovia
22 Sep 08	-1.72%	18	5.55	14.81	117	48400	99.70%	846	-81.60%	8	181.08%	6	12,502,000	29 Sep: taken over of Wachovia
25 Sep 08	1.62%	20	7.00	13.70	58	6568	83.30%	6593	-81.60%	5	158.57%	3	4,121,800	29 Sep: taken over of Wachovia
Call Options (15)														
11 Jul 08	-0.86%	13	1.70	11.54	36	5282	90.70%	7417	27.51%	7	211.76%	9	1,080,400	17 Jul: quarterly announcement
15 Jul 08	-1.70%	10	0.35	9.08	4	15541	98.70%	29187	27.51%	5	842.86%	3	4,103,800	17 Jul: quarterly announcement
18 Jul 08	-3.21%	13	2.18	12.97	29	51958	99.90%	53660	27.51%	2	143.68%	4	5,007,000	17 Jul: quarterly announcement
21 Jul 08	-2.14%	15	1.03	13.18	26	25982	99.50%	48387	27.51%	1	329.27%	10	1,773,600	17 Jul: quarterly announcement
30 Sep 08	1.17%	5	0.73	3.50	53	14438	97.30%	20253	90.22%	3	168.97%	4	700,240	6 Oct: offer to buy Wachovia
01 Oct 08	-0.68%	5	0.68	3.55	52	21237	98.90%	35462	90.22%	2	188.89%	3	894,280	6 Oct: offer to buy Wachovia

Table 12: Summary of detected informed trades for Wachovia Bank. For definition of entries see Page 18.

Wells Fargo Company (WFC)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (14)														
27 Dec 07	-0.04%	30	1.03	30.30	23	70717	99.90%	8710	-6.10%	15	256.10%	8	19,158,000	
01 Feb 08	0.48%	33	0.83	33.65	15	8353	95.30%	13513	-6.72%	4	281.82%	6	1,497,000	
04 Nov 08	-0.31%	37	3.30	35.11	18	6130	78.50%	6424	-18.97%	21	190.91%	7	4,824,000	10 Nov: sells 11bln in stock
06 Jan 09	0.82%	28	3.95	27.54	46	78828	99.90%	87010	-23.82%	12	259.49%	10	66,232,000	28 Jan: loss of fourth quarter
07 Jan 09	0.49%	28	4.80	25.87	45	24733	97.50%	25940	-23.82%	11	195.83%	9	21,451,000	28 Jan: loss of fourth quarter
08 Jan 09	0.26%	25	3.20	25.72	44	53561	99.30%	64303	-23.82%	10	251.56%	8	28,476,000	28 Jan: loss of fourth quarter
28 Jan 09	-2.31%	19	2.20	21.19	52	5080	67.30%	5540	-14.22%	12	115.91%	7	294,980	28 Jan: loss of fourth quarter
Call Options (15)														
18 Jan 08	-0.60%	25	1.70	25.48	29	7419	97.50%	9104	9.02%	5	423.53%	9	2,878,300	
07 Jul 08	-0.49%	28	1.10	23.52	103	11313	97.50%	13990	32.77%	10	165.91%	9	156,000	17 Jul: biggest one-day rally
15 Jul 08	-0.36%	23	1.03	20.51	32	22712	99.50%	29515	32.77%	4	690.24%	6	16,583,000	17 Jul: biggest one-day rally
10 Mar 09	-3.28%	11	2.70	11.81	39	13573	92.90%	15588	23.87%	12	159.26%	10	8,697,000	9 Apr: bank predicted record profit
16 Mar 09	-1.05%	18	0.75	13.70	33	5524	77.70%	5030	31.70%	21	193.33%	6	440,250	10 Apr: bank predicted record profit
01 Apr 09	1.90%	20	0.88	14.48	45	35308	97.10%	42665	31.70%	9	165.71%	7	3,895,600	11 Apr: bank predicted record profit
21 Apr 09	1.16%	20	2.23	18.81	60	12849	91.10%	13257	23.66%	12	156.18%	10	166,010	8 May: Ready Investors
23 Apr 09	1.55%	23	1.08	20.09	23	19491	95.30%	39358	23.66%	10	337.21%	10	4,108,900	8 May: Ready Investors
28 Apr 09	1.48%	18	3.85	19.48	53	5494	73.10%	5690	23.66%	7	163.64%	9	256,750	8 May: Ready Investors
30 Apr 09	1.80%	25	0.23	20.01	16	15771	93.90%	21883	23.66%	5	1366.70%	7	618,110	8 May: Ready Investors

Table 13: Summary of detected informed trades for Wells Fargo Company. For definition of entries see Page 18.

UBS

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (16)														
13 Feb 07	0.21%	78	1.53	76.00	Mar 07	5100	97.80%	5349	-3.86%	21	398.69%	16	3,597,400	
6 Jul 07	-0.10%	72	1.15	74.40	Aug 07	5153	95.80%	5617	-2.99%	15	462.61%	17	3,787,200	
12 Oct 07	0.43%	66	0.24	67.95	Oct 07	8327	93.00%	9288	-4.44%	15	420.83%	6	818,960	30 Oct: announcement of losses
16 Oct 07	0.51%	68	3.06	66.50	Dec 07	35563	99.80%	10	-4.44%	13	457.52%	19	11,765,000	30 Oct: announcement of losses
25 Oct 07	0.06%	60	4.04	62.45	Jun 08	26487	99.40%	0	-4.65%	20	250.00%	20	12,290,000	30 Oct: announcement of losses
11 Dec 07	0.49%	56	1.04	56.95	Dec 07	46430	99.80%	997	-3.56%	3	299.04%	9	14,088,000	10 Dec: posts 10 bn writedown
30 Jan 08	-0.51%	46	2.86	46.06	Mar 08	5271	81.80%	5534	-8.32%	12	261.54%	18	4'289'921	15 Feb: worst quarterly loss
11 Feb 08	-0.82%	36	1.51	39.74	Mar 08	3036	63.00%	3100	-8.32%	4	286.75%	20	1,609,460	15 Feb: worst quarterly loss
12 Feb 08	-1.03%	40	0.81	40.94	Feb 08	3374	65.80%	4654	-8.32%	3	391.36%	4	1,033,808	15 Feb: worst quarterly loss
22 Feb 08	-1.28%	33	0.96	35.68	Mar 08	6000	83.00%	6000	-7.42%	15	785.42%	17	2,832,300	15 Mar: bank run at Bear Stearn
27 Feb 08	-1.12%	24	0.37	37.48	Jun 08	15000	96.20%	15000	-7.42%	12	818.92%	14	1,785,000	15 Mar: bank run at Bear Stearn
04 Mar 08	-1.24%	30	1.50	32.08	Apr 08	9827	91.40%	12032	-7.42%	9	308.00%	10	1,206,100	15 Mar: bank run at Bear Stearn
16 May 08	-0.12%	32	1.38	32.16	Jun 08	19193	96.60%	20127	-6.95%	8	193.48%	7	5,102,400	26 May: more mortgage losses possible
Call Options (13)														
27 Sep 07	-0.05%	66	0.21	62.15	Oct 2007	12495	97.40%	2647	3.04%	3	1090.50%	8	2,476,000	
23 Nov 07	-1.27%	54	1.41	49.74	Jan 08	13495	95.80%	14355	6.65%	4	258.87%	12	4,140,600	
19 Aug 09	0.89%	17	0.26	16.74	Aug 09	38269	99.80%	50240	6.40%	3	523.08%	3	4,676,400	

Table 14: Summary of detected informed trades for UBS. For definition of entries see Page 18.

Credit Suisse Group (CS)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^S	τ_1	r_t^O	τ_2	G_t	Event's description
Put Options (16)														
13 Jul 07	-0.14%	76	2.73	82.19	Jun 08	11863	98.20%	12000	-3.44%	10	135.90%	12	581,290	
12 Oct 07	0.26%	80	2.12	75.02	Dec 07	9929	95.00%	9949	-3.73%	15	423.11%	20	1,705,300	
01 Nov 07	-0.23%	70	1.01	68.95	Dec 07	9382	94.20%	9500	-3.73%	1	754.46%	16	2,526,500	
07 Jan 08	-0.11%	60	1.97	58.84	Mar 08	9779	92.60%	11050	-8.41%	11	397.46%	11	868,470	
19 Feb 08	0.50%	52	2.46	48.72	Mar 09	13240	97.00%	14705	-6.61%	1	180.08%	20	1,150,200	20 Feb: new 2 bln write down
Call Options (13)														
16 Mar 07	-0.22%	88	1.29	75.50	Apr 07	5107	95.40%	5668	3.26%	5	230.23%	6	1,175,400	
23 Nov 07	-1.01%	68	1.85	57.87	Jan 08	11118	97.00%	11475	4.72%	4	162.70%	14	3,060,800	
23 Apr 08	0.20%	51	2.23	48.31	May 08	5006	86.60%	5056	5.98%	7	240.36%	7	1,351,300	
10 Sep 08	-0.06%	54	0.74	49.92	Sep 08	9850	93.00%	10300	18.63%	8	170.27%	8	1,201,000	
18 Sep 08	-0.38%	58	1.32	45.36	Dec 08	10010	93.00%	10010	27.92%	18	346.21%	12	1,396,600	13 Oct 08 oct: swiss banks raise emergency

Table 15: Summary of detected informed trades for Credit Suisse Group. For definition of entries see Page 18.

Deutsche Bank (DBK)														
Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (16)														
29 Jun 07	-0.23%	100	1.82	107.09	Sep 07	12660	96.60%	171	-3.55%	20	175.27%	20	4,793,800	
09 Jan 08	-0.12%	80	1.42	84.55	Feb 08	15157	94.20%	18422	-6.30%	9	507.75%	11	5,655,400	
14 May 08	0.22%	76	5.02	76.24	Jul 08	3648	71.40%	3698	-5.93%	13	180.08%	20	4,134,800	
19 May 08	0.09%	76	6.51	76.64	Dec 08	6700	89.00%	8570	-5.93%	10	133.03%	18	4,852,300	
30 May 08	-0.24%	68	1.91	68.98	Jul 08	5596	86.20%	5775	-5.93%	1	468.06%	20	3,987,000	
08 Aug 08	0.72%	58	1.06	63.07	Sep 08	5759	86.60%	7277	-5.28%	4	228.30%	10	1,131,000	
18 Sep 08	-0.56%	46	3.52	48.84	Dec 08	10425	94.60%	13405	-14.79%	17	369.60%	17	3,447,800	
19 Sep 08	-0.65%	54	2.27	58.18	Oct 08	5889	87.80%	7050	-14.79%	16	903.96%	16	10,753,000	
01 Oct 08	-0.73%	32	1.23	51.46	Dec 08	5424	85.40%	5932	-14.79%	8	796.75%	20	1,523,800	
Call Options (3)														
30 Mar 07	0.07%	100	2.61	100.70	Apr 07	6094	91.00%	540	3.43%	14	384.29%	14	5,834,600	

Table 16: Summary of detected informed trades for Deutsche Bank. For definition of entries see Page 18.

Société Générale (GL)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (16)														
25 Jul 07	-0.20%	130	2.72	131.28	AUG07	3020	98.20%	0	-4.84%	12	168.75%	4	2,631,284	
9 Jan 08	-0.54%	88	1.67	94.99	FEB08	326	52.60%	0	-8.72%	9	531.14%	9	317,002	18 Jan: speculation of huge writedowns
16 Jan 08	-0.25%	92	3.95	94.93	MAR08	856	77.60%	0	-8.72%	4	444.05%	9	1,446,670	18 Jan: speculation of huge writedowns
05 May 08	0.79%	77	1.19	78.45	MAY08	520	61.10%	50	-3.16%	4	410.92%	7	187,170	14 May: First Quarter Profit Drops 23.4%
16 May 08	0.18%	70	2.12	71.85	JUN08	400	48.20%	50	-3.81%	16	169.81%	10	325,128	14 May: First Quarter Profit Drops 23.4%
8 Sep 08	-0.46%	58	0.85	66.81	OCT08	500	54.70%	NaN	-9.59%	6	642.35%	8	661,000	15 Sept: collapse of Lehman Brothers
9 Sep 08	-0.23%	67	1.42	68.50	SEP08	2285	96.20%	NaN	-9.59%	5	817.61%	7	311,230	15 Sept: collapse of Lehman Brothers
Call Options (8)														
28 Sep 07	0.22%	130	1.15	117.68	NOV07	3155	98.90%	550	4.11%	3	228.70%	6	2,404,519	
24 Jan 08	-1.04%	90	1.26	75.81	MAR08	3000	97.00%	0	10.63%	4	372.22%	7	5,264,540	12 Feb: seeks to raise \$8 Billion
29 Jan 08	-1.55%	100	0.94	78.45	MAR08	1500	86.50%	120	10.63%	1	189.36%	4	4'186'500	12 Feb: seeks to raise \$8 Billion
18 Sep 08	-0.61%	72	0.41	55.86	Oct 08	1120	71.20%	241	19.16%	2	563.41%	2	1,706,445	
28 Oct 08	-2.19%	48	0.60	33.34	Nov 08	963	60.30%	200	11.87%	6	431.67%	7	1,761,747	

Table 17: Summary of detected informed trades for Société Générale. For definition of entries see Page 18.

BNP Paribas (BN)

Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (16)														
14 Jan 08	-0.37%	70	1.10	73.72	FEB08	271	38.90%	0	-10.20%	6	618.18%	6	130,601	30 Jan: quarterly profit will slump over 40%.
15 Jan 08	-0.27%	68	0.98	72.25	Feb 08	2458	95.40%	68	-10.20%	5	546.94%	5	1,777,858	30 Jan: quarterly profit will slump over 40%.
16 Jan 08	-0.23%	64	2.78	73.17	Jun 08	4139	99.00%	120	-10.20%	4	172.30%	4	559,877	30 Jan: quarterly profit will slump over 40%.
18 Jan 08	-0.15%	64	1.68	69.39	Mar 08	1000	66.00%	20	-10.20%	2	175.60%	4	98,734	30 Jan: quarterly profit will slump over 40%.
26 May 08	0.02%	68	2.67	66.60	Jun 08	1000	69.60%	5	-4.08%	10	176.40%	10	659,500	
30 May 08	-0.04%	66	1.61	66.34	Jun 08	2445	94.60%	NaN	-4.08%	6	294.41%	9	1,335,947	
03 Oct 08	0.32%	70	3.08	71.35	Oct 08	141	27.60%	2	-13.47%	18	386.69%	10	156,023	28 Oct: crash
07 Oct 08	0.36%	66	3.03	68.43	Oct 08	511	51.80%	NaN	-13.47%	16	263.37%	8	412,633	28 Oct: crash
21 Oct 08	-0.83%	58	5.56	59.00	Nov 08	2500	93.00%	100	-13.47%	6	96.28%	6	3,326,778	28 Oct: crash
Call Options (13)														
26 Jul 07	-0.29%	80	3.34	79.12	Sep 07	600	73.50%	0	6.08%	17	247.62%	10	1,195,800	
04 Dec 07	0.41%	70	2.50	74.00	Feb 08	1464	86.60%	0	2.77%	2	197.56%	5	954,371	
23 Sep 08	0.73%	60	1.90	64.53	Oct 08	638	62.70%	656	8.23%	9	544.83%	9	1,137,240	Positive signals from US bailout program
25 Sep 08	0.70%	66	4.51	67.21	Dec 08	3045	92.50%	1000	8.23%	7	173.21%	9	8,279,315	Positive signals from US bailout program

Table 18: Summary of detected informed trades for BNP Paribas. For definition of entries see Page 18.

HSBC (HSB)														
Day	M_t	K	P_t	S_t	τ	ΔOI_t	q_t	V_t	r_t^s	τ_1	r_t^o	τ_2	G_t	Event's description
Put Options (12)														
12 Oct 07	0.41%	940	5.00	953.00	Oct 07	3000	93.50%	0	-2.73%	15	230.00%	6	3,450,000	
11 Dec 07	0.16%	850	12.50	851.50	Dec 07	1200	69.70%	0	-2.64%	3	112.00%	5	840,000	
07 Jan 08	0.14%	840	28.50	833.00	Feb 08	56	20.30%	0	-6.38%	11	212.28%	8	374,200	recession hurts demand for loans
10 Jan 08	-0.18%	840	29.50	814.00	Jan 08	23	8.30%	0	-6.38%	8	193.22%	5	131,100	recession hurts demand for loans
14 Jan 08	-0.23%	780	13.50	811.00	Feb 08	461	40.50%	106	-6.38%	6	459.26%	6	1,452,400	recession hurts demand for loans
Call Options (5)														
10 Sep 07	-0.14%	880	18.00	870.00	Sep 07	3000	95.80%	25	2.63%	18	111.54%	8	16,500,000	
25 Sep 07	0.05%	900	12.50	909.00	Oct 07	888	66.20%	5	2.63%	7	122.22%	9	3,937,000	

Table 19: Summary of detected informed trades for HSBC. For definition of entries see Page 18.

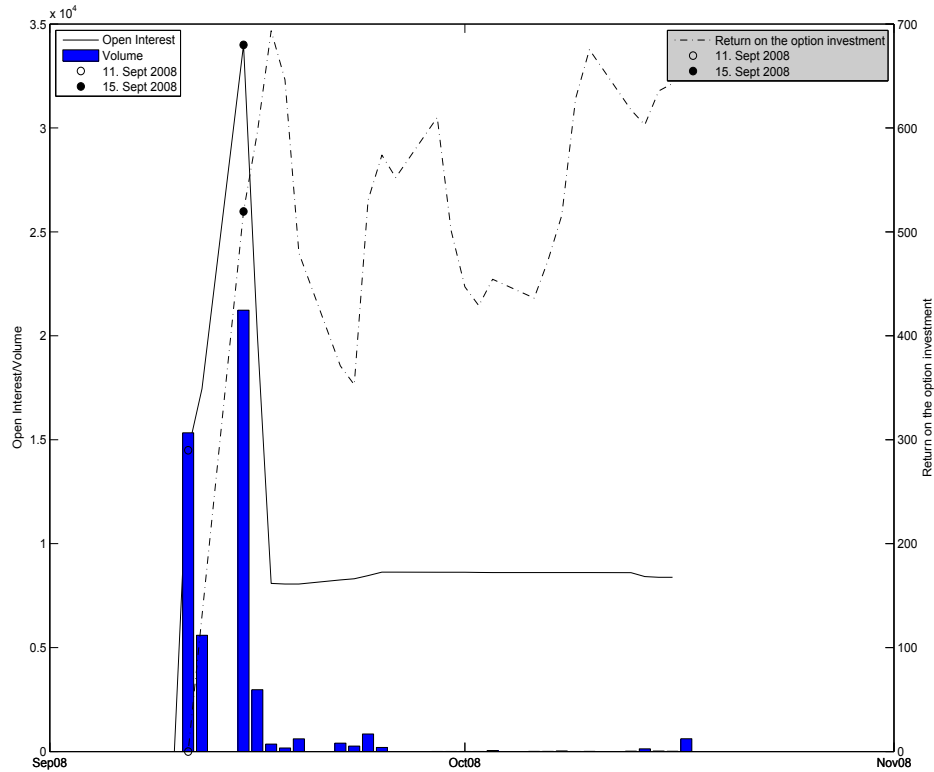


Figure 1: Selected put option with underlying stock AIG before the Federal Reserve Board announced that it would take a nearly 80% equity stake in AIG—effectively taking over the firm—and would provide an \$85 billion loan on September 15th, 2008. The solid line shows the daily dynamic of open interest, the bar the corresponding trading volume (left y-axis) and the dash-dot line, the option return (right y-axis). The empty circle is the day of the transaction, the filled circle is the announcement day, September 15th, 2008. This put option had a strike of \$8 and matured at the end of October 2008.

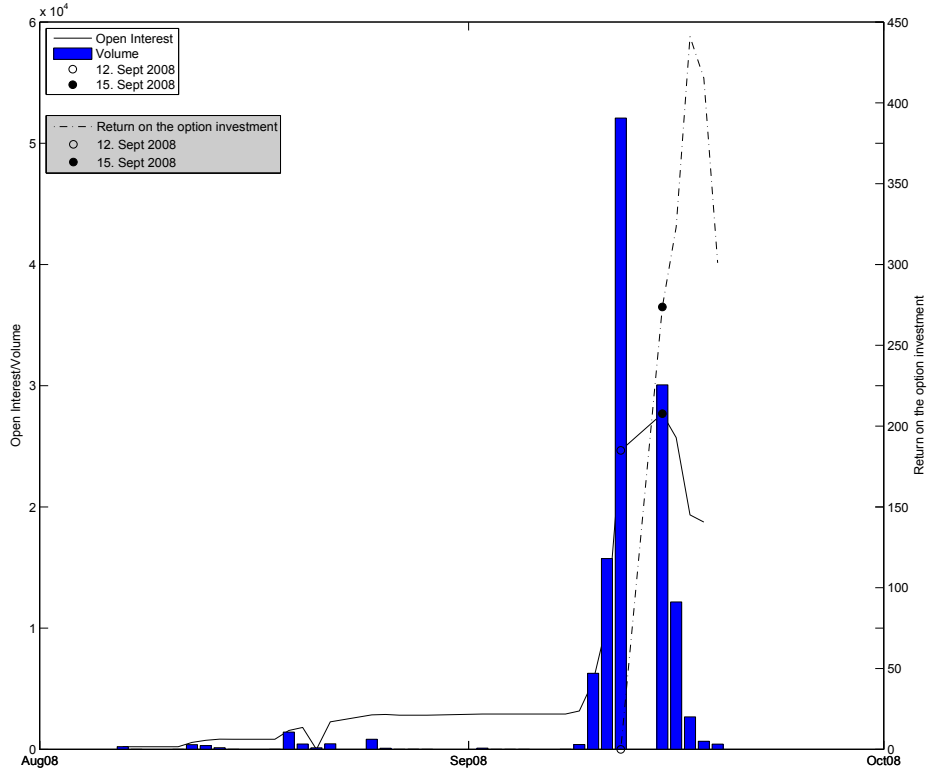


Figure 2: Selected put option with underlying stock AIG before the Federal Reserve Board announced that it would take a nearly 80% equity stake in AIG—effectively taking over the firm—and would provide an \$85 billion loan on September 15th, 2008. The solid line shows the daily dynamic of open interest, the bar the corresponding trading volume (left y-axis) and the dash-dot line, the option return (right y-axis). The empty circle is the day of the transaction, the filled circle is the announcement day, September 15th, 2008. This put option had a strike of \$10 and matured at the end of September 2008.

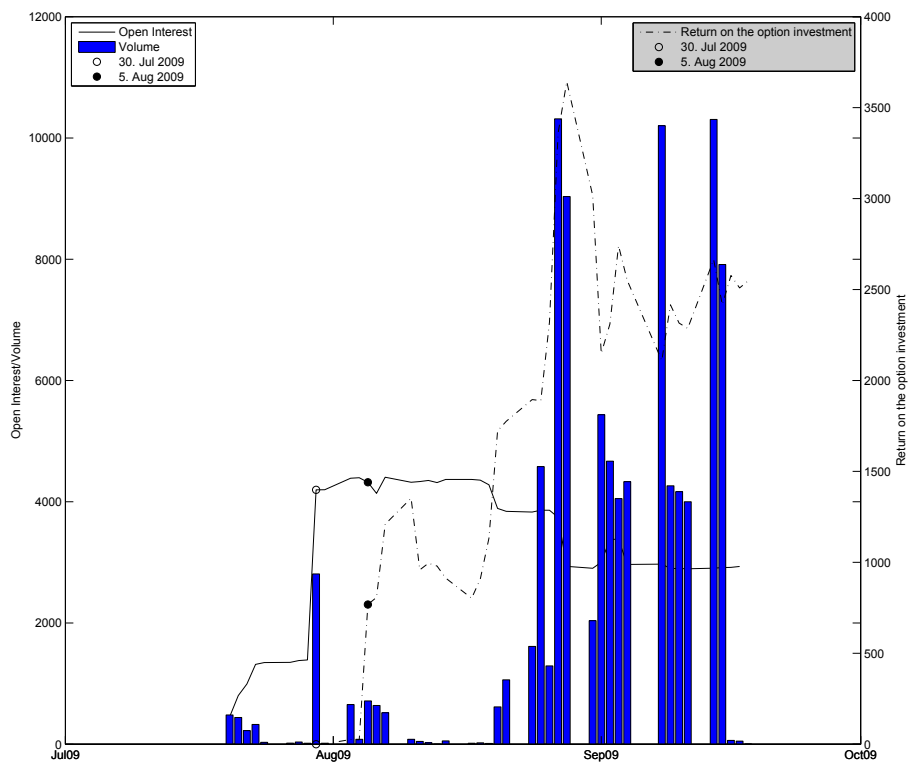


Figure 3: Selected call option with underlying stock AIG before the August 7th, 2009 quarterly profit announcement that almost doubled the stock value. The solid line shows the daily dynamic of open interest, the bar the corresponding trading volume (left y-axis) and the dash-dot line, the option return (right y-axis). The empty circle is the day of the transaction, the filled circle is the announcement day, August 7th, 2009. This call option had a strike of \$15 and matured at the end of September 2009.

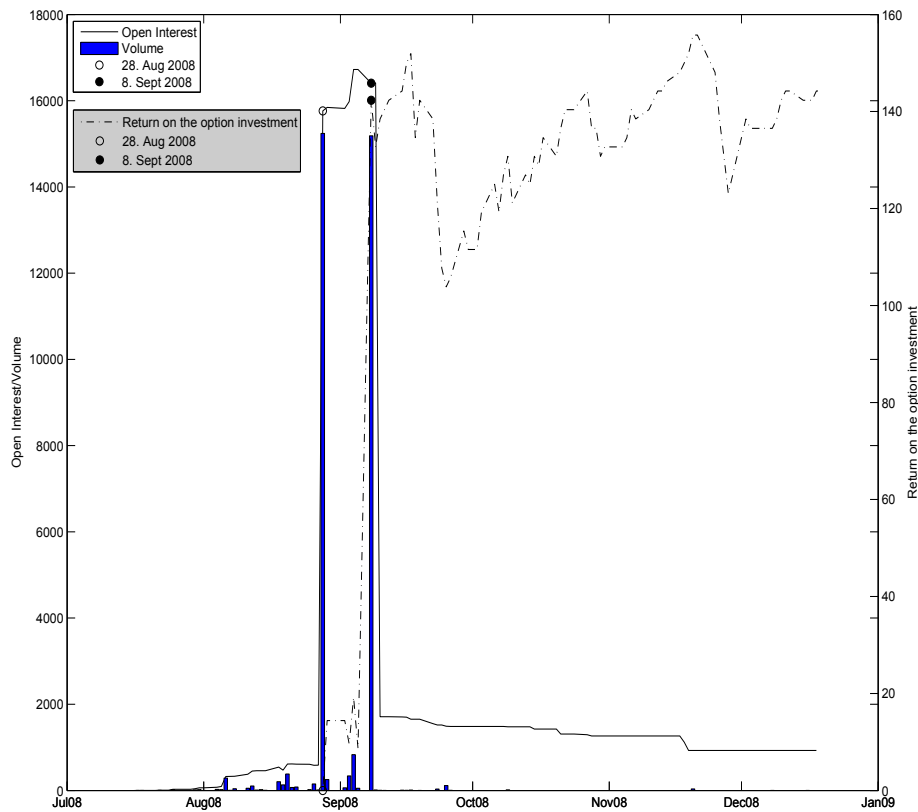


Figure 4: Selected put option with underlying stock Fannie Mae before the federal takeover on September 5th, 2008. The informed option trade takes place on August 28th, 2008. The solid line shows the daily dynamic of open interest, the bar the corresponding trading volume (left y-axis) and the dash-dot line the option return (right y-axis). The empty circle is the day of the transaction, August 28th, 2008, and the filled circle is Monday, September 8, when the stock price of Fannie Mae crashed by almost 90% to under \$1. This put option had a strike of \$7 and a time-to-maturity of more than 100 days.

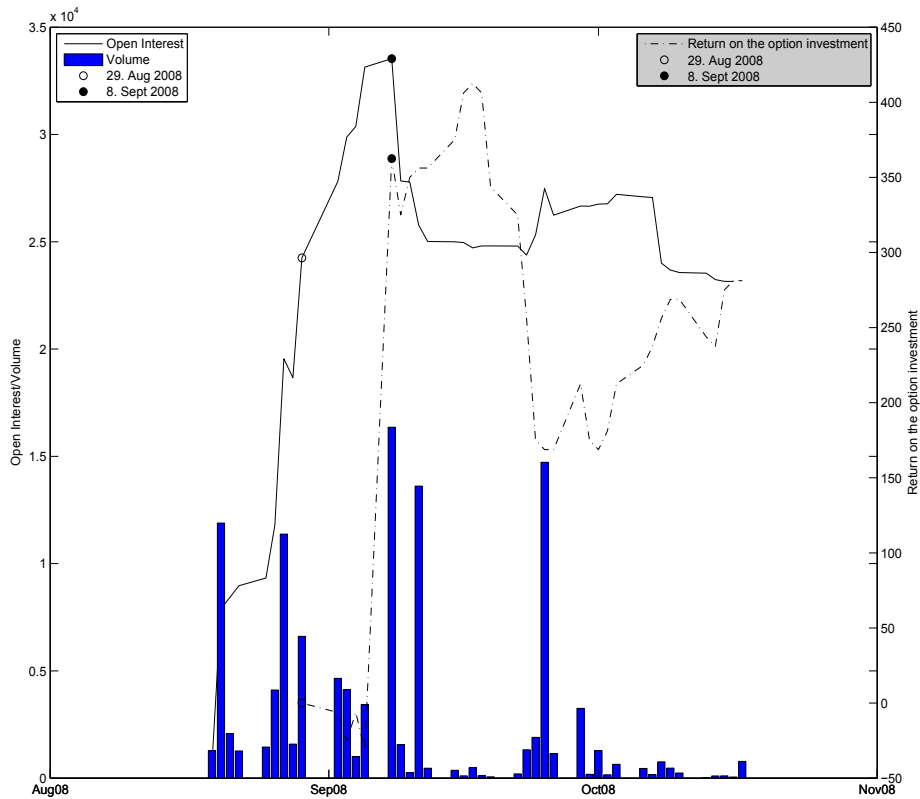


Figure 5: Selected put option with underlying stock Fannie Mae before the federal takeover on September 5th, 2008. The informed option trade takes place on August 29th, 2008. The solid line shows the daily dynamic of open interest, the bar the corresponding trading volume (left y-axis) and the dash-dot line the option return (right y-axis). The empty circle is the day of the transaction, August 29th, 2008, and the filled circle is Monday, September 8th, when the stock price of Fannie Mae crashed by almost 90% to under \$1. This put option had a strike of \$3 and a maturity at the end of October 2008.

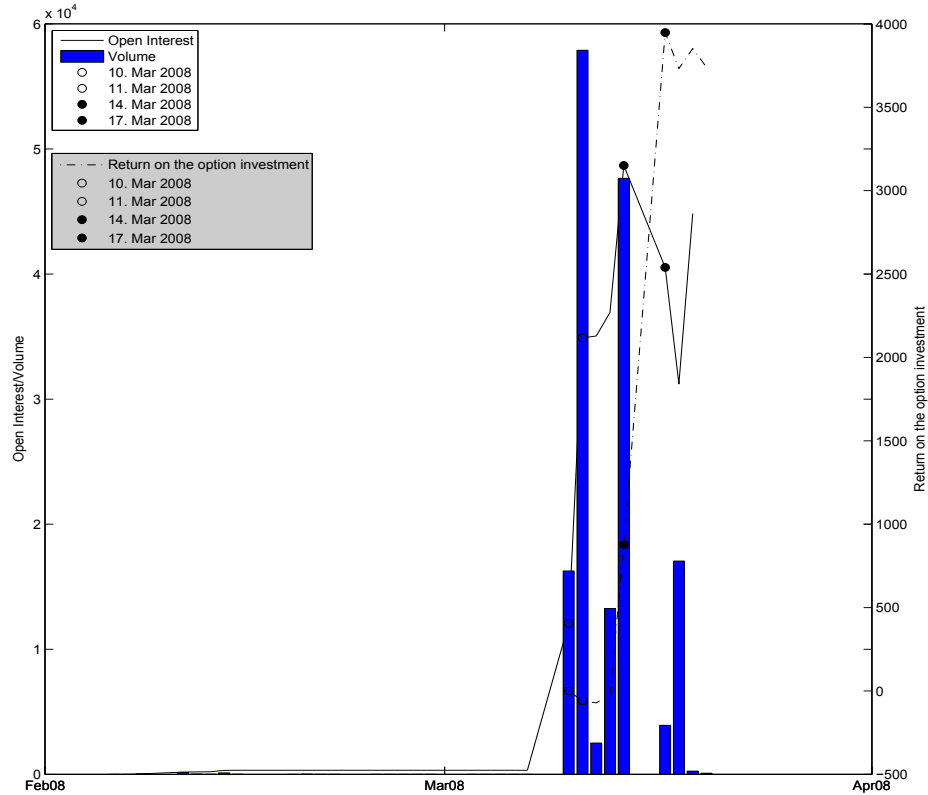


Figure 6: Selected put option with underlying stock Bear Stearns before the company collapse on March 17th, 2008. The informed option trade takes place on March 10th, 2008. The solid line shows the daily dynamic of open interest, the bar the corresponding trading volume (left y-axis) and the dash-dot line, the option return (right y-axis). The empty circle is the day of the transaction, the filled circle is Monday, March 17th, the day Bear Stearns shares dropped nearly 90% to \$2.86. This put option had a strike of \$30 and matured at the end of March 2008.

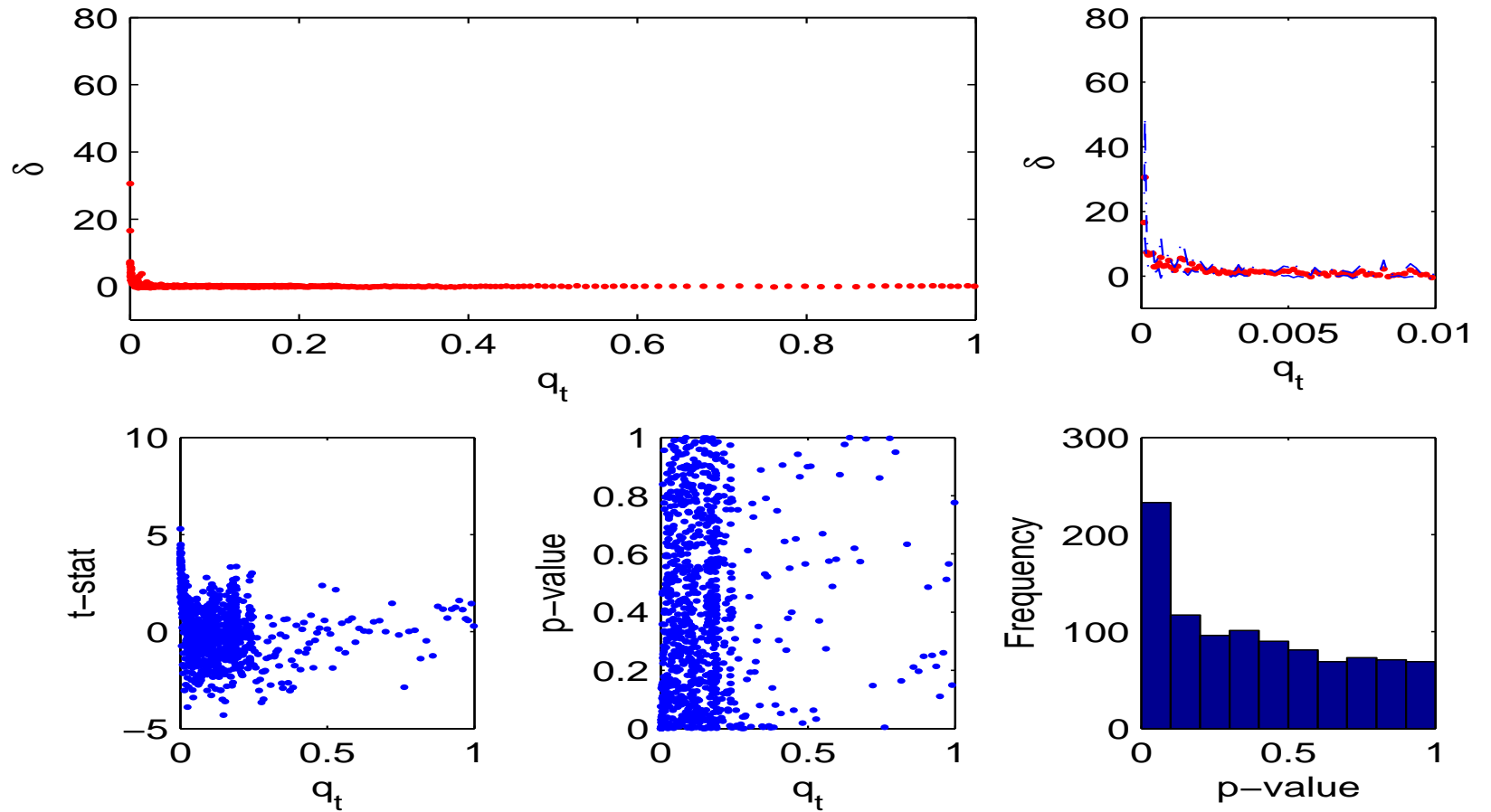


Figure 7: False Discovery Rate for Lehman Brothers. The upper-left graph shows on the x-axis the ex-ante probability q_t , the right-end point in each subinterval I_m , and on the y-axis the corresponding average option returns δ_m associated to the m th option trader. The upper-right graph shows the same quantities when $0 \leq q_t \leq 0.01$. Dashed-dotted lines represent 95% confidence intervals for δ_m . The lower graphs, from left to right, show t -statistics of option returns associated to the M option traders for the null hypothesis $H_0 : \delta_m = 0, m = 1, \dots, M$, corresponding p -values, and histogram of p -values, respectively.