The biggest warrant auction in U.S. history

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Abstract

On December 10, 2009, the auction of JP Morgan Chase's warrants raised gross proceeds of $950 million, topping the previous warrant auction record of the 1983 Chrysler warrants in real and nominal terms. This paper analyzed the results from the secondary market trading on December 9, 2009, of the Troubled Asset Relief Program (TARP) warrants issued by Capital One Financial (COF) to estimate the likely auction price of the JP Morgan Chase (JPM) TARP warrants. The Capital One Financial warrants have displayed an implied volatility discount relative to other historic and implied volatility metrics. The paper translates the percent volatility discounts from traded TARP warrants to estimate the likely implied volatility of long-dated TARP warrants that have not yet gone to auction.

Keywords: bailout, banks, J.P. Morgan Chase, TARP, valuation, warrants

1. Introduction

JP Morgan Chase was among the first nine banks that received funds from the Capital Purchase Program (CPP).[1] These capital injections were part of the Troubled Asset Relief Program (TARP), which was enacted in the midst of the worst financial crisis in the United States since the Great Depression. JP Morgan Chase received $25 billion on October 28, 2008, in exchange for preferred stock and warrants to purchase 88,401,697 shares of JP Morgan's (JPM) stock for the price of $42.42 on or prior to October 28, 2018. $25 billion was the most money that any institution has received from the Capital Purchase Program (CPP) for healthy banks. JP Morgan Chase repaid the preferred stock on June 17, 2009, along with ten other large bank holding companies, including Capital One. The eight other large banks repurchased the taxpayers' warrants for approximately $2.9 billion by the end of August 2009, according to Congressional Oversight Panel (2009b).

JP Morgan Chase's auction on December 10, 2009, was the largest warrant auction in U.S. history up to that date with gross proceeds of over $950 million and net proceeds of $936 million. The JP Morgan auction topped the $311 million nominal proceeds (or $675 million in 2009 dollars) that were raised by the U.S. Treasury in 1983 when it auctioned of the warrants of Chrysler Motors. According to Wilson (2009b), the warrants in the 1983 Chrysler auction were obtained as compensation for federal loan guarantees, which helped the auto company avoid bankruptcy.

Prior to the JP Morgan auction, the author circulated this paper's estimates based on the closing prices on December 9, 2009, which were sent to several members of the media. These estimates had also been reported in the original draft of this paper, which was posted on the Social Science Research Network. Since the estimates barely changed on December 10, 2009, the author did not revise his estimates on December 10, 2009, the day of the auction which closed at 6:30 P.M. New York time. The author's pre-auction median estimate of $9.75 per warrant was reported on in the *Financial Times*.[2] (The

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[1] Source: Mark Landler and Eric Dash, October 15, 2008, "Drama Behind a $250 Billion Banking Deal," *New York Times*, accessed online December 23, 2008 at http://www.nytimes.com/2008/10/15/business/economy/15bailout.html.

[2] The author wrote a blog about his estimates on December 9, 2009, at http://seekingalpha.com/article/177481-the-biggest-warrant-auction-in-u-s-history. The author's pre-auction middle estimates was reported in Francesco Guerrera and Alan Rappeport, December 11, 2009, "Treasury draws $936m from JPMorgan warrants," *Financial Times*, accessed online on December 20, 2009, at http://www.ft.com/cms/s/0/2e72a436-e677-11de-98b1-00144feab49a.html. The gross proceeds of the auction were $950 million or about $88 million more than the author's estimate of $9.75 per warrant times 88.4 million warrants. The author's estimate of $10.50 per warrant based on the December 4, 2009, closing prices was reported in Colin Barr, December 8, 2009, "Treasury cashing in on JPMorgan stake," *Fortune*, accessed online on December 19, 2009, at http://money.cnn.com/2009/12/08/news/companies/jpmorgan.warrants.fortune/. One analyst predicted a price of $12 to $13 per warrant, and the other predicted $13 to $17 per warrant in Peter Eichenbaum, December 10, 2009, "U.S. Should Delay JPMorgan Warrants Sale, Pluris Says (Update3)" *Bloomberg,* accessed online on December 19, 2009, at http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a0Ifyb7xKSRQ. An unnamed derivatives trader believed that the price would be $11 to $12 per warrant in Andrew Bary, December 10, 2009, "JPMorgan Warrants Sale May Net $1.2B for Uncle Sam," *Barrons*, accessed online on December 19, 2009, at http://online.barrons.com/article/SB126046261181485795.html. The median estimate $11 of

author rounded to the nearest $.25 since the bids had to be in $.25 increments.) In Bloomberg the estimates of two other analysts were reported. Those estimates had medians of $12.50 and $15, respectively. While the author's middle estimate was within a dollar of the $10.75 per warrant auction price, a couple of derivative traders did better with median guesses of $11.50 and $11 in articles in *Barrons* and the *Dow Jones Newswires*, respectively. Thus, in this natural experiment, the author's methodology did pretty well relative to other estimates widely circulated at the time.[3] Unlike the sources of the other estimates mentioned above, this paper makes its methodology available so that this procedure can be used by others to estimate the value of TARP warrants which have not yet been auctioned.

Like the Capital One auction that preceded it on December 3, 2009, the JPM auction was a modified Dutch auction. In this auction, the U.S. Treasury set a reservation price of $8 per warrant.[4] Investors submitted sealed bids rising in increments of $0.25 cents per warrant. The warrants were sold in minimum lots of 100 warrants. Any investor who bid over the market clearing price got all the warrants he or she requested at the uniform price. Any investor who had bid at the market clearing price of $10.75 received a partial allocation on a *pro rata* basis, according to the preliminary prospectus. Consider the following example where about 88.4 million warrants are being auctioned. Bidder A bids for 40 million warrants at $16 per warrant; Bidder B bids for 30 million warrants at $13 per warrant; and Bidder C bids for 30 million warrants at $10.75 per warrant. If all other bids are lower than bidder C, then the price set by auction is $10.75 per warrant. Bidder A gets 40 million warrants, and Bidder B gets 30 million warrants. Bidder C gets 18.4 million or about [(18.4 million)/(30 million)]*100 percent = 61.3 percent of his or her desired quantity at a price of $10.75 per warrant.

The Capital One Financial warrant auction priced the 12,657,960 warrants at $11.75 apiece. This generated gross proceeds of $148.7 million before underwriter fees or $146.5 million in net proceeds after fees and expenses.[5] Capital One Financial and JP

George Ruhana of OptionsHouse was reported on Steven D. Jones, December 9, 2009. "IN THE MONEY: If JPM Plays Wild Card, Warrants Could Top $11," *Dow Jones Newswires*.

[3] The author was unable to find any media reports of anyone else's estimates for the TCF Financial warrants' likely auction price. The author's final pre-auction estimate was also close to the price obtained in the TCF Financial auction of $3.00 per warrant obtained on December 15, 2009. His median estimate was $2.50 per warrant which was reported in Matthew Monks, December 17, 2009, "TCF Price May Signal Revived Interest," *American Banker*. The midpoint of his range was closer to the auction price of $3.00. The range of $1.82 to $4.89 per warrant was reported after the auction in Joshua Fineman and Peter Eichenbaum, December 16, 2009, "Treasury Sells TCF Financial's Warrants for $3 Each (Update1)" *Bloomberg*, accessed online on December 20, 2009, at http://www.bloomberg.com/apps/news?pid=20601087&sid=a05sSKcUYJwY&pos=5.

[4] U.S. Treasury, December 8, 2009, "Press Release: Treasury Department Announces Public Offering of Warrants to Purchase Common Stock of JPMorgan Chase & Co." accessed online on December 9, 2009, at http://www.ustreas.gov/press/releases/tg432.htm.

[s] U.S. Treasury, December 4, 2009, "Press Release: Offering of Warrants to Purchase Common stock of Capital One Financial Corporation" accessed online on December 9, 2009, at http://www.ustreas.gov/press/releases/tg427.htm. JP Morgan Chase could bid for its JPM-WS warrants both in the auction or buy them in the secondary market according to the preliminary prospectus at http://www.sec.gov/Archives/edgar/data/19617/000119312509249391/d424b7.htm.

Morgan Chase after the auctions disclosed that it did not win any warrants at auction.[6] The price of the Capital One warrants and the secondary market trading represented a discount to what the author and others have expected, based on the historic and implied volatilities of shorter term options.[7] Indeed, some of the banks with the largest and most successful derivatives trading desks in the world such as Morgan Stanley and Goldman Sachs agreed to prices $0.95 billion and $1.1 billion, respectively, that in light of the COF-WS warrant auction seem rich. Thus, it makes sense to recalibrate volatility estimates since the opening up of the long-dated warrant market in the United States in December 2009.

Value Line's *Convertible Survey* tracks the publicly traded warrants in the United States. The longest dated warrant will expire on February 26, 2014. Most warrants in the November 23, 2009, survey, or fifty-five of the sixty-six warrants listed, had expiration dates shorter than that of the longest traded options, which in November 2009 had expirations in January 21, 2012. The total market capitalization of the U.S. warrant market, according to that survey, was $1.21 billion on November 13, 2009. The market capitalization of the JP Morgan warrants with a ticker JPM-WS and the Capital One Financial warrants with a ticker COF-WS, which trade on the New York Stock Exchange (NYSE), exceeded $1.21 billion at the close of trading on December 14, 2009, assuming no warrants had been retired by their issuer at that point.[8]

This paper estimates the value of the JP Morgan Chase warrants were worth about $859 million, which was close to the eventual auction price of JP Morgan Chase's gross proceeds of $950 million. This estimate and the auction price is on the low end of recent estimates by Congressional Oversight Panel (2009b), which, according to Congressional Oversight Panel (2009a), uses a similar options pricing methodology of Merton (1973) with dilution adjustments of Galai and Schneller (1978) that this paper does.

This paper's estimate is obtained by using the secondary market implied volatilities of the Capital One Financial warrants to estimate the likely implied volatilities of the JP Morgan's warrants in the secondary market. The secondary market trading of

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[6] Capital One said it did not win any warrants at auction in an 8-K filed with the Securities and Exchanges Commission (SEC) on December 7, 2009, at http://www.sec.gov/Archives/edgar/data/927628/000119312509248044/d8k.htm. A spokesperson from JP Morgan Chase confirmed that the bank did not bid for any warrants at auction to *Bloomberg* in Peter Eichenbaum and Joshua Fineman, December 11, 2009, "JPMorgan TARP Warrants Sold by Treasury Fetch $10.75 (Update2)," accessed online on December 20, 2009, at http://www.bloomberg.com/apps/news?pid=newsarchive&sid=azxUif3PvCo8.

[7] Meena Thiruvengadam, December 8, 2009, "Correct: Capital One Auction Suggests Lower TARP Revenue Ahead," *Dow Jones Newswires*; Matthew Monks, December 7, 2009, "Cap One Warrants a Trend?" *The American Banker*. Colin Barr, December 8, 2009. "Treasury Cashing in on JPMorgan Stake," Fortune.com http://money.cnn.com/2009/12/08/news/companies/jpmorgan.warrants.fortune/.; Steve D. Jones, December 3, 2009, "In the Money: Options Point To $20 Warrant For Capital One," *Dow Jones Newswires*.

[8] The 1983 auction of Chrysler's warrants is also discussed in light of the TARP in Congressional Oversight Panel (2009a); Eckblad, Marshall, June 25, 2009, "Tussle Over Bank Warrants Echoes Early '80s Chrysler Fight," *Dow Jones Newswires*, accessed online on July 17, 2009, at http://online.wsj.com/article/BT-CO-20090625-711470.html.; Steven D. Jones, August 21, 2009,"It's an Auction Conundrum at J.P. Morgan," *Wall Street Journal*, C10, accessed online at http://online.wsj.com/article/SB125080277461547531.html.; and Darrell A. Hughes And Marshall Eckblad, "Treasury to Unload Capital One Warrants" *Wall Street Journal*, accessed online on December 9, 2009, at http://online.wsj.com/article/SB10001424052748704342404574575941836962438.html.

the Capital One warrants, and subsequently the JP Morgan and TCF Financial warrants have shown a tendency to trade at implied volatilities below that of other traded options and below most historic volatility measures. Thus, it is a better approach to adjust whatever volatility metric is used downward by the ratio of that metric to the implied volatility of banks with publicly traded TARP warrants. This procedure is modeled in Table 2.

The paper proceeds as follows. The data and methods that are used to obtain the parameter estimates are in section 2. In section 3 the valuations are presented. In section 4, the author concludes.

2. Data, Estimates, and Valuation Methods

The author obtained stock price and dividend data from Yahoo! Finance. The prices of the January 2012 call options were obtained from MSN Money. The prices of the COF-WS warrants were obtained from www.InvestorPoint.com. Treasury rates were obtained from the U.S. Treasury web site. Strike prices, expiration dates, and the numbers of warrants outstanding were taken from SIGTARP (2009).

2.1. Volatility Estimates

The most important input into an option pricing model is the volatility. We will devote this section to discussing the volatilities estimated. Five different volatility estimates were used. Three were selected for the valuation range of JP Morgan Chase's (JPM) warrants. Two of the three selected volatilities were adjusted downward, based on the ratio of those volatility metrics for Capital One Financial to the implied volatility of Capital One Financial's TARP warrants (COF-WS) at the close of trading on December 9, 2009. The average implied volatility of the January 2012 call options with strike prices of $40 and $45 were used as one volatility metric for the Capital One Financial and JP Morgan Chase warrants, which both have strike prices between $42 and $43, of $42.13 and $42.42, respectively. An index of implied volatilities, the 10-year historic volatility, the 2-year historic volatility, and the author's estimates from a GARCH(1,1) model were also used to obtain volatility estimates. The estimates were ranked from lowest to highest. Below, we will explain how the volatilities were calculated.

2.1.1 Implied Volatility of the January 2012, $40 and $45 Calls

The implied volatility of the call options that expire on January 21, 2012, was estimated for both Capital One Financial and JP Morgan Chase. These are often referred to as Long-term Equity AnticiPation Securities (LEAPS). The details of these contracts are summarized in Table 1. The closing share price and last options trade were used to estimate the implied volatility. The January 2012 $40 and $45 call options' implied volatilities were averaged to obtain the implied volatility of the January 2012 LEAPS.

[*Insert Table 1 about here.***]**

2.1.2 IV Index Implied Volatility

The implied volatility IV index call is compiled by ivolatility.com, which provides historic option price data, and this index is posted on the Chicago Board Options Exchange (CBOE) site. Implied volatilities for traded options are calculated and the index is a weighted average of those volatilities. Each option's *vega* is used as its weight in the index. An option's *vega* measures how sensitive the option's price is to a change in the stock price's volatility. An option is at-the-money when the strike price equals the stock price. When an option is at-the-money, it is the most sensitive to volatility estimates, and the implied volatility estimates tend to be the most accurate.

The current readings of the IV index calls are in the thirty-to-forty percent range in Table 2. These readings are much lower than the 52-week highs reached by this index of implied volatilities. The 52-week highs for COF and JPM were 237.07 percent and 143.58 percent, respectively. These highs were reached in April 23, 2009, and January 29, 2009, respectively. In the late spring through the summer, volatilities for all traded options have generally fallen dramatically as stock markets have rallied. On December 4, 2009, the VIX index of the implied volatility of S&P 500 options stood at 21.25 percent per year. This is close to its historic average of 20.28 percent.[9]

2.1.3 GARCH(1,1) Average Volatilities

The author estimated the GARCH(1,1) model. GARCH stands for the generalized autoregressive conditional heteroskedasticity model. This methodology was developed by Bollerslev (1986). Heterosckedasticity stands for differing variance. Suppose that the subscripts denote the time period. The subscript "*t*" stands for the current time period. The GARCH(1,1) model assumes the current variance is a function of the last squared error term, u_{t-1}^2, and the last period's variance, σ_{t-1}^2.

$$\sigma_t^2 = \omega + \alpha u_{t-1}^2 + \beta \sigma_{t-1}^2$$

Since the author used daily data, the variance estimated was daily variance. The author used Kurt Annen's Microsoft Excel add-in at www.web-reg.de to find the maximum likelihood estimates for all three companies. The author attempted to estimate the GARCH(1,1) model from November 24, 2009, going back ten years. This effort was successful in the case of JP Morgan Chase. Unfortunately, the GARCH(1,1) model produced estimates of variance that were mean fleeting, not mean reverting for Capital One Financial for time periods going back between five-to-ten years in annual increments. If the GARCH(1,1) model does not mean revert, then it provides little guidance for future variance. The GARCH(1,1) model for Capital One did produce mean reverting results for the last four years since November 25, 2005. Yet, the last four years were more volatile than the last ten. Thus the average GARCH(1,1) variance for the next nine years is probably too high in the estimation of Capital One Financial, relative to the

[9] Mark Gongloff, December 7, 2009, "Ahead of the Tape: The Fear Gauge is Flashing Complacency," *Wall Street Journal,* C1.

other estimates. The average volatility to expiration estimates from the GARCH(1,1) model for each bank is displayed in Table 2.

2.1.4 10-Year and 2-Year Historic Volatilities

The author used closing stock prices from November 24, 2009, going back ten or two years to calculate the simple historic volatility. The author adjusted the closing stock price for dividends and stock splits. The log-returns were calculated and the historic volatility was calculated as outlined in Hull (2003, pp. 238-241).

2.1.5. Adjusting the volatilities

The ratio of the implied volatility of the Capital One Financial warrants (COF-WS) is expressed as a percent of various other metrics of the volatility of the Capital One stock's instantaneous returns. This percent is multiplied by those metrics, which are the IV index call implied volatility, the 2012 LEAP's implied volatility, the GARCH(1,1) average volatility, the 10-year historic volatility, and the 2-year historic volatility for JPM's stock. Those estimates are on Table 2.

The author used the median adjusted estimate as the low-end volatility estimate for the JP Morgan Chase (JPM-WS) warrants. If he used the lowest estimate of about 13.5 percent with the 10-year average dividend yield, that would have led to a warrant price well below $5.75. Since $5.75 is the closing price of the January 2012, $45 call in Table 1, that would have been cause for an arbitrage opportunity. Warrant prices below the January 2012, $45 call would mean an investor could buy a call option (the warrant) with a lower strike price, $42.42, and a longer time to maturity, nearly nine years, and pay for the purchase by shorting the January 2012, $45 call. (The dilution adjustments are minor for the warrants and cannot explain price discrepancies in excess of the percent ownership dilution by warrant exercise.) As it stands, the low estimate is below the auction's reservation price of $8 per warrant. All implied volatility estimates are from option prices on December 9, 2009. The historic volatility and GARCH(1,1) estimates have their latest observation November 24, 2009, and go back between two and ten years from that date. The middle estimate for JPM's warrants is the maximum adjusted estimate. The high estimate is the minimum unadjusted volatility estimate for JP Morgan Chase.

[*Insert Table 2 about here.***]**

2.2 Dividend yield estimates

The author used three different dividend yield estimates. Lower dividend yields are associated with higher warrant valuations. Thus, the low, middle, and high dividend yield estimates are used in the high, middle, and low valuation estimates respectively. The lowest dividend yield is the current continuously compounded dividend yield at the close of December 9, 2009. This is calculated by dividing the current dividend by the current stock price. The quarterly compounding yield is annualized and adjusted for continuous compounding by taking the natural log of the annualized dividend yield. The

high estimate is the average dividend over the last ten years, divided by the average stock price. The dividend yield estimates for COF are in Table 1, and the dividend yield estimates used for JPM are in Tables 3 and 4.

2.3 Risk-Free Rates

The author used the U.S. Treasury yields reported by the U.S. Treasury.[10] For the January 2012 option implied volatility calculations, the 2-year U.S. Treasury note yield of 0.76 was used. This was turned into a continuously compounding rate by calculating ln(1.0076). For the risk-free rates for the warrant valuations, the 7-year, T-note yield was multiplied by 1/3, and the 10-year, T-note yield was multiplied by 2/3. These two multiples were added together. A natural log was taken of one-plus-the-sum to adjust the yield for continuous compounding. This resulted in a continuously compounding risk-free rate of 3.21 percent.

2.4 Valuation methods

The best known option pricing model is Black and Scholes (1973). Nevertheless, that model does not adjust for the payment of dividends. Financial stocks are heavy dividend payers. Dividends reduce the value of the stock approximately by the value of the dividends paid, all other things being equal. Warrant or option investors do not get to collect dividends until they exercise their options. The author adjusts for the payment of dividends with the option pricing model of Merton (1973). Veld (2003) argues that Merton (1973) performs as well as any other pricing model in studies of warrant pricing. Warrant exercise increases the number of shares outstanding. At the same time, the firm collects cash from warrant exercise, which increases the value of the firm. On balance, warrant exercise puts a slight downward pressure on the stock price. To account for this the author uses the numerical procedure suggested by Galai and Schneller (1978). Like this paper Wilson (2009a; 2009b; 2009c), and Congressional Oversight Panel (2009a) use Merton (1973) with the dilution adjustments of Galai and Schneller (1978).

3. Results

The estimates are based on the closing prices on December 9, 2009. This is the date when the JP Morgan Chase auction was announced. The most striking thing is the gap between the two-year call option implied volatilities and the volatilities of the COF-WS warrants with nearly nine years to expiration. The 2-year LEAPS had an implied volatility of about 41.41 percent versus 24.92 percent for the 9-year warrants. This suggests that investors have much lower volatility expectations over the nearly seven years from the end of January 21, 2012, to November 14, 2018, or investors were only willing to purchase the warrants at a significant discount to their expected volatility. There are even larger gaps for all other volatility metrics in relation to the 9-year warrants.

[10] The link to the U.S. Treasury rates accessed on December 8, 2009, is http://www.ustreas.gov/offices/domestic-finance/debt-management/interest-rate/yield.shtm.

In Table 3, the key inputs for the valuation are summarized. This data is obtained from SIGTARP (2009), Yahoo! Finance, and the JP Morgan warrant's preliminary prospectus.

[*Insert Table 3 about here.***]**

The JP Morgan Chase's warrants' value ranges from $6.64 to $16.67 apiece or between $587 million to $1,474 million. While the low-end estimate does not create an obvious arbitrage opportunity, it comes close. Further, it is less than the reservation price of $8 per warrant. The combination of both the 3.18 percent dividend yield and the 19.31 percent volatility push down the low-end estimate in the same way that the combination of the 0.47 percent dividend yield and the 30.84 percent volatility push up the high estimate.

[*Insert Table 4 about here.***]**

4. Conclusion

On Thursday, December 10, 2009, the largest warrant auction in U.S. History generated gross proceeds of $950 million. This topped the 1983 Chrysler warrant auction in real 2009 dollars of $675 million, according to Wilson (2009b), and nominal dollars of $311 million.

This paper estimated prior to the auction, that the auction would fetch about $859 million. The pre-auction estimates were obtained by analyzing the implied volatilities of traded warrants which began trading on December 4, 2009. The results of the Capital One Financial auction, which raised gross proceeds of $148.7 million on December 3, 2009, or net proceeds for taxpayers of $146.5 million, indicated that private investors were not willing to pay as much for volatility when they buy the nearly 9-years-to-expiration Troubled Asset Relief Program (TARP) warrants as they are willing to pay for shorter-term, exchange-traded options with maturities of up to two years. The implied volatility of the Capital One warrants of about 25 percent per year is much less than the implied volatilities of two-year options of about 41.5 percent, according to Table 2. Similar patterns emerged after the JP Morgan Chase auction. The implied volatility of the auction price for the JP Morgan Chase warrants was 23.1 percent compared to 31.1 percent for call options expiring in 2012.[11]

The Capital One warrant investors paid $12.80 at the close of trading on December 9, 2009, according to Table 1. Using the 10-year historic volatility in Table 2 and the 10-year average dividend yield of 0.50 percent, those investors could expect the warrants to be worth $23.40 if they both hold the warrants to exercise, and those estimates are correct. That indicates they could expect returns of about 7.4 percent per annum in excess of the risk-free rate. Black and Scholes (1973) argue that the value of a call option portfolio is expected to rise with the risk-free rate. Thus, the total returns

[11] These were calculations that the author did for Matthew Monks, December 14, 2009, "Cheap Price of Warrants Helps Banks," *American Banker*.

could be about 10.7 percent per year over nine years. If those investors hedged out their stock price risk, delta risk, those could be very good risk-adjusted returns indeed.[12]

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Wilson, Linus, (2009c), "Valuing the First Negotiated Repurchase of the TARP Warrants," *SSRN working paper*, accessed online on December 8, 2009,at http://ssrn.com/abstract=1404069.

[12] If the warrant is under priced selling correctly priced traded options or selling a synthetic warrant are possible ways to make excess profits. Yet, those strategies take active management by experienced investors or professionals. The selling of short-term options is one way that investors can hedge their stock price exposure to long-term options according to Olagues and Summa (2010). The approach suggested by Black and Scholes (1973) is known as delta hedging. In that approach, the trader owns the warrant, which is supposedly under priced, but she shorts or sells some quantity of the warrant's underlying stock and owns some U.S. Treasury securities.

Table 1: Implied Volatility of Long-Term Traded Options of Capital One Financial (COF) and JP Morgan Chase (JPM)

Panel 1:

Option Contract	Ticker	Option Price at Close	Strike Price	Expiration Date	Closing Price Date
Capital One Warrants	COF-WS	$12.80	$42.13	11/14/2018	12/9/2009
Capital One's January 2012 $40 Call Option	YFNAH	$8.50	$40.00	1/21/2012	12/9/2009
Capital One's January 2012 $45 Call Option	YFNAI	$7.15	$45.00	1/21/2012	12/9/2009
JP Morgan Chase's January 2012 $40 Call Option	WJPAH	$8.00	$40.00	1/21/2012	12/9/2009
JP Morgan Chase's January 2012 $45 Call Option	WJPAL	$5.75	$45.00	1/21/2012	12/9/2009

Panel 2:

Option Contract	Continously Compunding Risk-Free Rate	Dividend Yield	Stock Price	Time to Expiration	Implied Volatility
Capital One Warrants	3.21%	0.50%	$38.61	8.9370	**24.92%**
Capital One's January 2012 $40 Call Option	0.76%	0.52%	$38.61	2.1178	**40.91%**
Capital One's January 2012 $45 Call Option	0.76%	0.53%	$38.61	2.1178	**42.10%**
JP Morgan Chase's January 2012 $40 Call Option	0.76%	0.49%	$41.19	2.1178	**31.56%**
JP Morgan Chase's January 2012 $45 Call Option	0.76%	0.49%	$41.19	2.1178	**30.13%**

Table 2: Volatility Metrics and Adjusted Volatilities of Capital One Financial (COF) and JP Morgan Chase (JPM)

	Capital One Financial (COF)		JP Morgan Chase (JPM)	
Description	**Actual Estimated Volatilty**	**warrant implied volatilty as % estimated volatility**	**Actual Estimate**	**Projected 9-year warrant volatility**
Jan 2012 LEAPS implied volatilty	41.51%	60.04%	30.84%	18.52%
IV Index implied volatility	44.76%	55.68%	34.69%	19.31%
GARCH(1,1) volatility	65.31%	38.16%	35.40%	13.51%
10-year historic volatility	60.35%	41.29%	49.84%	20.58%
2-year historic volatility	98.38%	25.33%	82.14%	20.81%
		Minimum	**30.84%**	13.51%
		Median	35.40%	**19.31%**
		Maximum	82.14%	**20.81%**

Capital One Financial's warrant's (COF-WS)'s implied volatility = 24.92%

Table 3: Valuation Inputs

	JP Morgan (JPM)
Closing Stock Price on December 9, 2009	$41.19
Strike Price	$42.42
Expiration Date	October 28, 2018
Time to Expiration in Years	8.8904
Number of Warrants Outstanding	88,401,697
Number of Shares Outstanding in Millions	4,104.93
Current Dividend Yield	0.47%
10-Year Average Dividend Yield	3.18%
Risk-free rate to expiration	3.21%

Table 4: Valuation of the Warrants Issued by JP Morgan Chase (JPM)

	JP Morgan Chase (JPM)		
	Low	**Middle**	**High**
Dividend Yield	3.18%	1.83%	0.47%
Volatility	19.31%	20.81%	30.84%
Estimated per Warrant Value	$6.64	$9.72	$16.67
Estimated Total Warrant Value in Millions	$587	$859	$1,474