

The Rise and Fall of Apple-linked Structured Products¹

The rise in Apple's market capitalization in 2012 coincided with a dramatic increase in single-observation reverse convertibles, reverse convertibles and autocallable notes linked to Apple's stock price. These notes all transfer the downside risk of owning Apple to investors but cap the upside at somewhat more than corporate bond yields. Issuers use individual stocks like Apple as the reference obligations for reverse convertible structured products because investors underestimate the risk of losses when the individual stock's price falls.

The decline in Apple's stock price from over \$700 in September 2012 to less than \$400 in April 2013 has resulted in over one hundred million dollars of losses in Apple-linked structured products. In this paper, we summarize our published reports on over 800 Apple-linked structured products and identify the impact of Apple's recent stock price decline on investors in these structured products.

I. Introduction

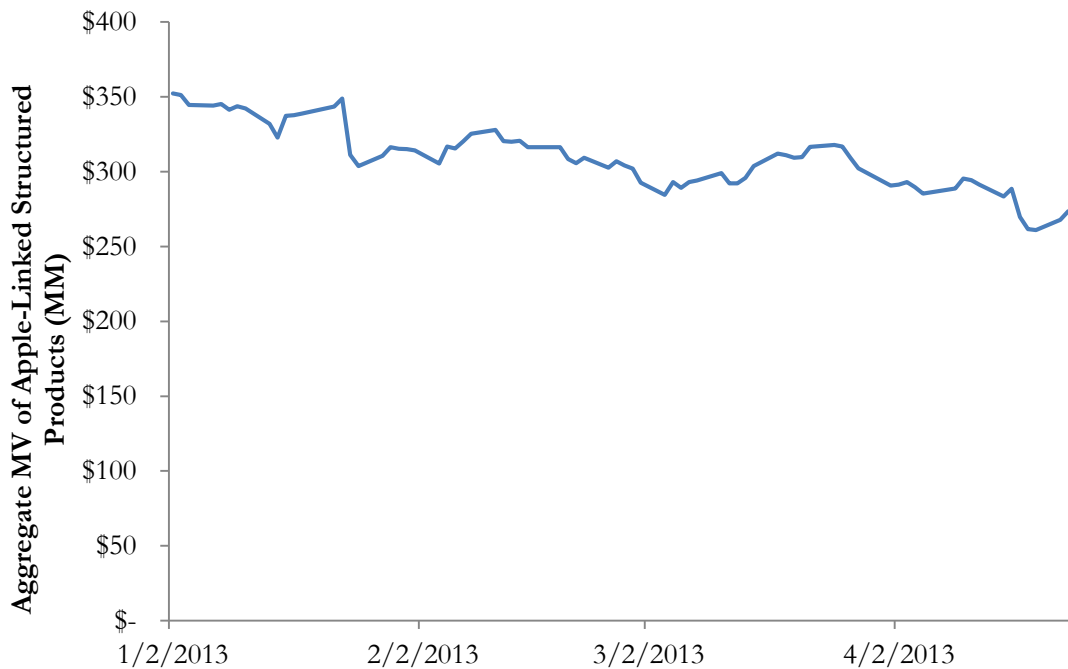
Reverse convertibles are short-term notes whose principal repayment is linked to the performance of a stock or a group of stocks. If the underlying stock's price falls below a pre-specified level during the term of the note, investors may receive substantially less than the face value of the notes. Reverse convertibles tend to pay higher coupon rates than traditional notes because, in addition to the issuer's credit risk, the notes expose investors to the risk of a decline in the price of the reference security.

SLCG's database of Structured Products Research Reports includes reports on over 800 Apple-linked structured products including 283 products which have not yet matured as of April 24, 2013 and which were outstanding as of January 23, 2013. The aggregate market value of these 283 Apple-linked products was \$348,839,033 on January 23, 2013 and \$311,219,694 on January 24, 2013. After the close on January 23, 2013, Apple announced disappointing earnings and its stock price fell over 12% on January 24,

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2013. Investors in the 283 Apple-linked products we value on a daily basis lost \$37,7619,339, or over 10%, in one day and have lost an additional \$37 million over the following three months.² This dramatic event illustrates the risk of structured products linked to volatile individual stocks like Apple. Figure 1 plots the aggregate market value of the Apple-linked structured products which have not yet matured as of April 24, 2013 and which were outstanding as of January 23, 2013.

Figure 1: Aggregate market value of Apple-linked structured products from January 2, 2013 to April 24, 2013.



Almost all the Apple-linked structured products are reverse convertibles. Issuers like UBS, Barclays and JP Morgan issue reverse convertibles linked to volatile individual stocks rather than to less volatile stock indexes because investors underestimate the downside risk in volatile stocks and are over-confident in stocks they believe will continue to increase in value. Investors' underestimation of risk and overconfidence in likely returns allow investment banks to pay investors below market compensation for the banks' credit risk and for the market of the embedded short put options.

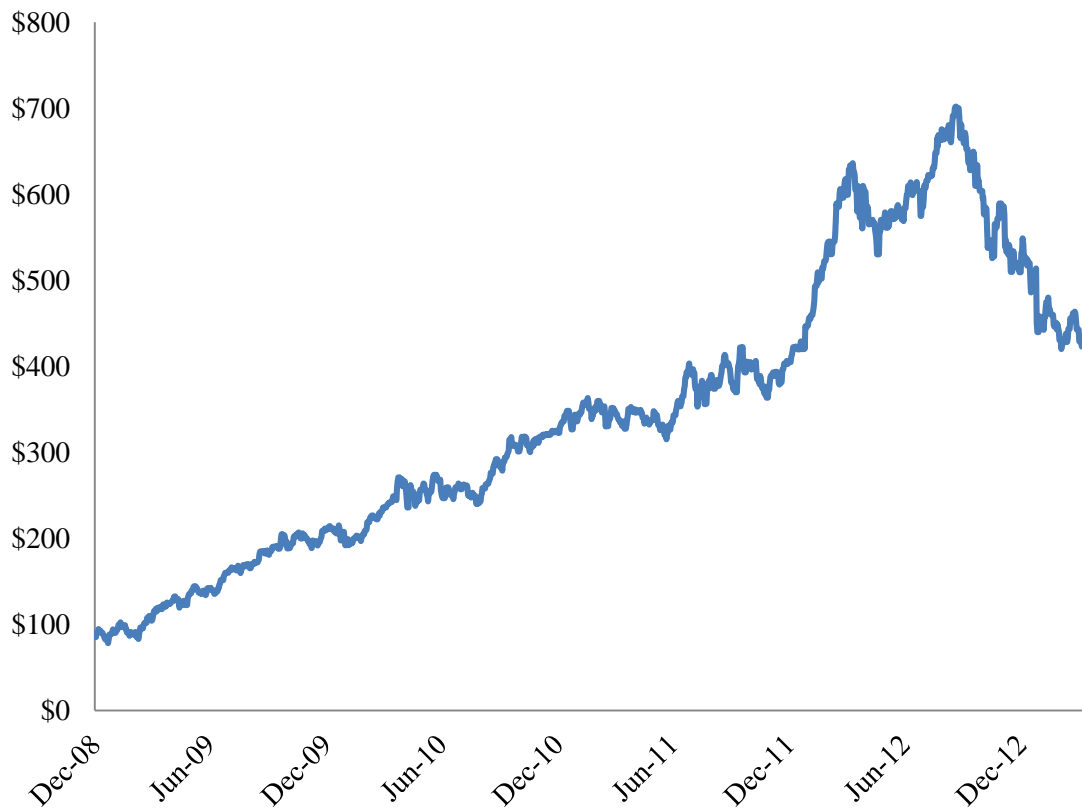
² The 314 Apple-linked products in our sample that had not yet matured as of January 24, 2013, lost \$39.3 million.

II. Apple's Stock Price, Volatility and Structured Products Issuance

A. Apple's stock price and market capitalization increases.

Apple's closing stock price increased 675%, from \$90.75 on January 2, 2009 to \$702.10 on September 19, 2012, subsequently declined 36% to \$450.50 on January 24, 2013 and decreased another 10% by April 24, 2013. Apple's closing stock price since December 31, 2008 is plotted in Figure 2.

Figure 2: Apple's Closing Stock Price, December 31, 2008 to April 24, 2013.



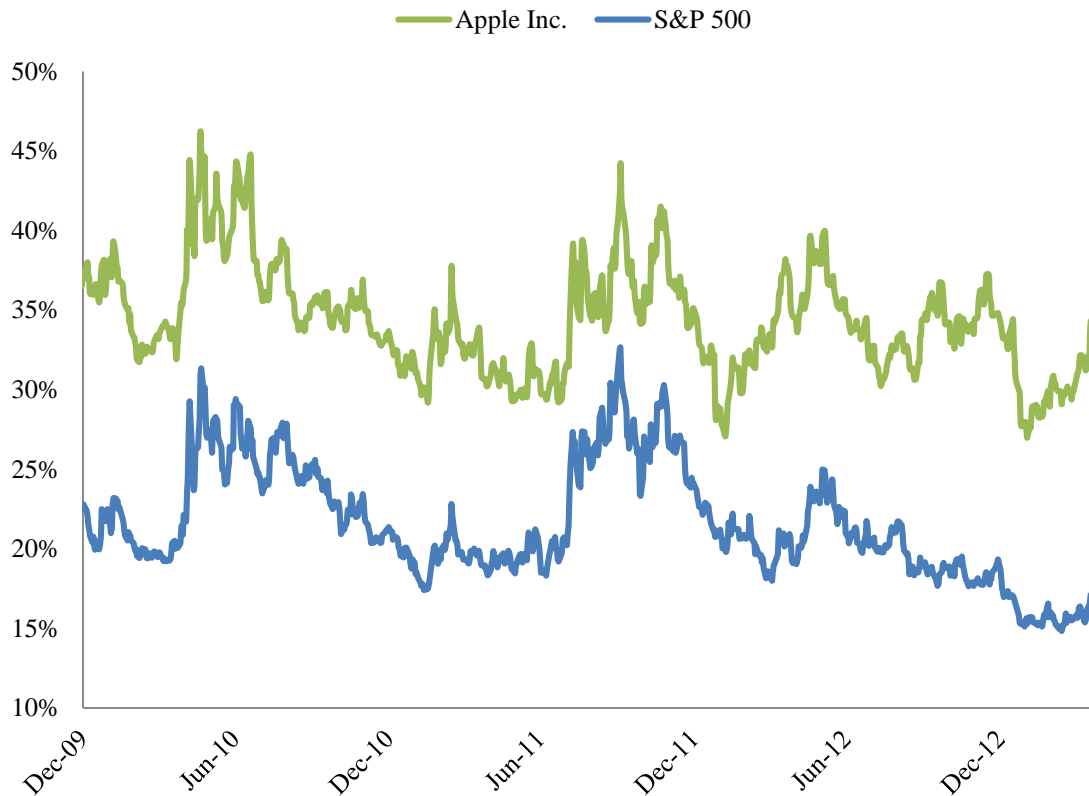
B. Apple's stock has become more volatile over time.

Reverse convertibles are short put options attached to unsecured notes. When an investor buys a reverse convertible from an investment bank like UBS, Barclays or JP Morgan, they are effectively selling the bank a put option on the referenced stock and posting the note's purchase price as collateral to ensure the bank that the investor will pay above market prices for the referenced stock if its price drops below some threshold

price. The put option investors sell to the investment bank is more valuable, the more volatile the stock is expected to be during the term of the reverse convertible.

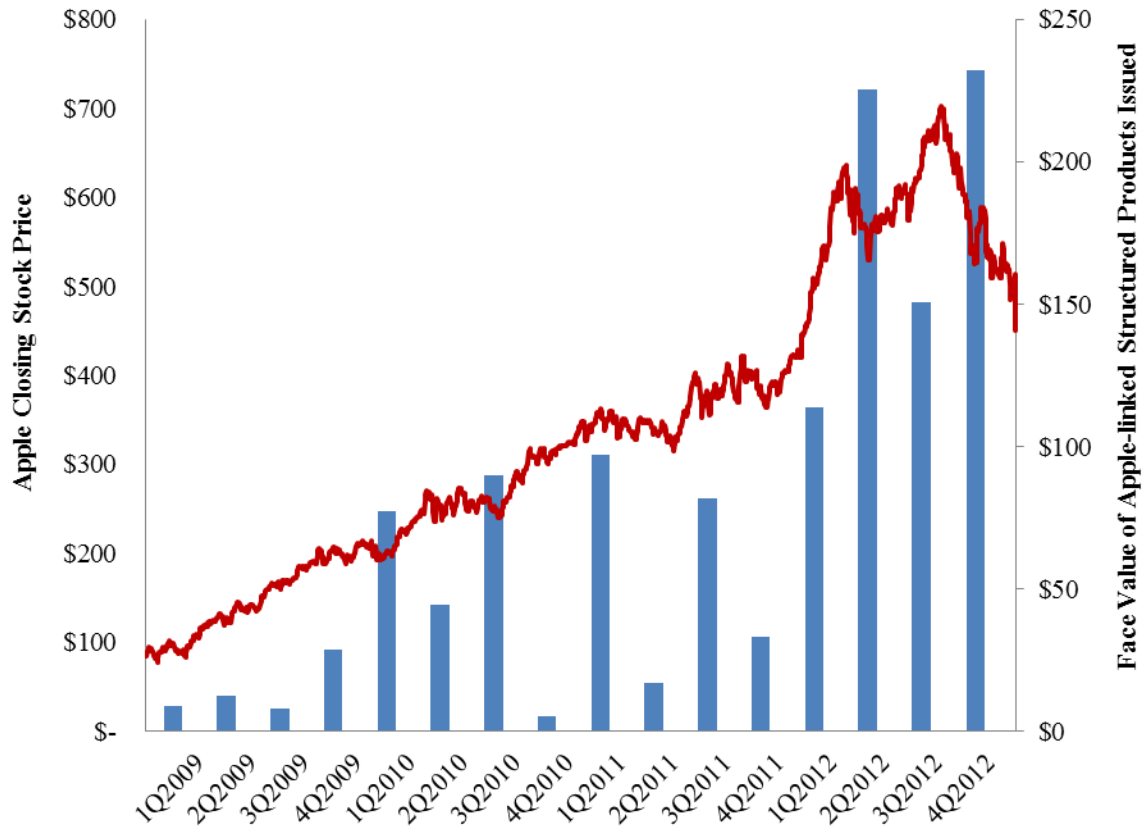
Apple's stock price has become more volatile relative to the broad market. See Figure 2. If the impact of Apple's increased volatility on the value of the embedded put options is not understood by retail investors, investment banks will be able to make more money issuing Apple-linked structured products.

Figure 3: Apple's Implied Volatility, December 31, 2011 to April 24, 2013.



C. Issuance of Apple-linked Structured Products Has Increased with Apple's Stock Price.

The number of structured products issued each quarter which were linked to Apple's stock price increased significantly along with Apple's stock price. See Figure 3.

Figure 4: Apple-linked Structured Product Issuance by Quarter, 2009-2012, Millions


III. Single Observation Reverse Convertibles, Interim-Risk Reverse Convertibles and Autocallable Reverse Convertibles

A. Single Observation Reverse Convertibles

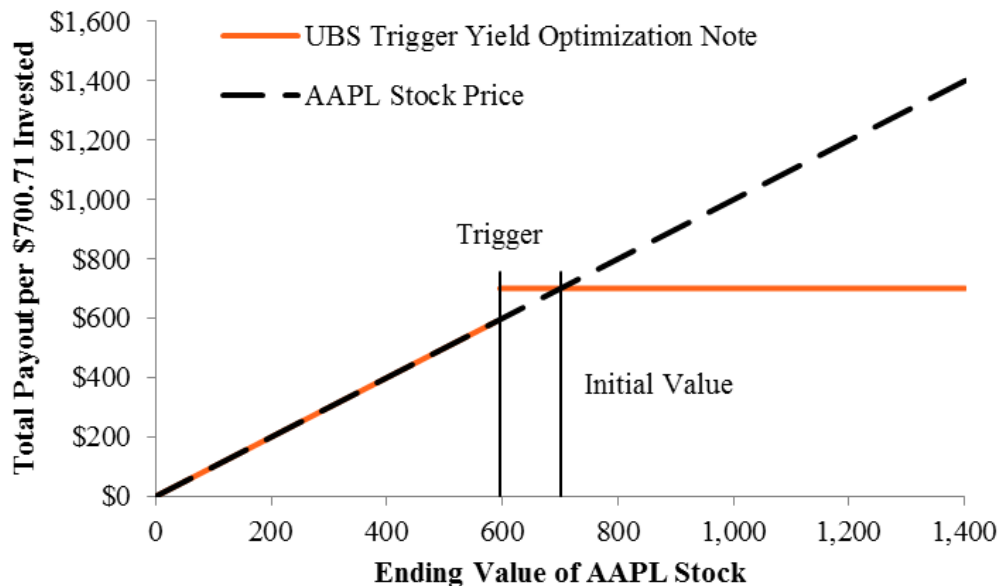
Single Observation Reverse Convertibles (SO Reverse Convertible) are the simplest type of reverse convertible. These notes pay investors monthly, bi-monthly, quarterly or semiannual coupons and at maturity pay an amount that depends only on the closing price of the underlying security on the valuation date which is typically a few days before the maturity date.

UBS's September 26, 2012 Apple-linked SO Reverse Convertible

Consider for example, the Trigger Yield Optimization Notes linked to Apple Inc. issued by UBS on September 26, 2012.³ These 1-year notes mature on September 26, 2013 and pay an 8.03% annual coupon, quarterly. Investors will get the 8.03% coupon no matter what happens to Apple's stock price so long as the issuer, UBS, doesn't default.

The Pricing Date - the date on which the terms of a structured product are set - for this note was September 21, 2012. Apple's closing stock price on that date was \$700.71. If Apple closes below \$595.60 (85% of the \$700.71 Initial Price price) on the Valuation Date, September 23, 2013, investors will receive one share of Apple. If, on the other hand, Apple's stock price closes above \$595.60 on September 23, 2013 investors will get \$700.71. The payoffs to this note are illustrated in Figure 4.

Figure 5: Maturity Payoff to UBS's September 26, 2012 Apple-linked SO Reverse Convertible



An investor who bought and held a one-year UBS bond paying 8.03% coupon and sold a one-year European binary put option that pays the holder \$105.21 if Apple closes at or below \$595.60 at maturity a one-year short European put option with a \$595.60

³ SLCG's Structured Product Research Report for this security can be found at www.slcg.com/pdf/tearsheets/90270B489.pdf. UBS's SEC filing can be found at www.sec.gov/Archives/edgar/data/1114446/000111444612011791/stp603561f_1fwp.htm

strike price would receive the quarterly coupons and at maturity would receive the net of \$700.71 (the note's face value) minus \$105.21, if Apple is less than \$595.60 (payoff to the binary option) minus the amount, if any, by which Apple's closing price is less than \$595.60 (payoff to the short put option).

These payoffs are identical to the payoffs of the Apple-linked UBS reverse convertible in our example and so we can value the UBS reverse convertible by valuing the securities described in the previous paragraph. On September 21, 2012 when UBS set the terms of this note, a one-year UBS bond paying 8.03% coupon was worth \$745.59, the binary option would have been worth -\$36.88 and the put option was worth -\$37.13, and so the Apple-linked note was worth \$671.59 per \$700.71 note or 95.84% of face value. A few days later when the note was actually issued, Apple's stock price had already declined 5% to \$665.18 and so the note was worth only \$657.81 per \$700.71 note, or 93.88% of its face value when it was issued.

We can also value this note on each day since it was issued. At Apple's \$514.01 closing price on January 23, 2013, the note was worth \$571.38 per \$700.71 note, or 81.54% of face value. At Apple's \$450.50 closing price on January 24, 2013, the note was worth \$511.14 per \$700.71 note, or 72.95% of face value. Thus, as Apple's stock price fell 12% because of its disappointing earnings announcement after the close on January 23, 2013, the value of this note fell almost 9%. The \$511 January 24, 2013 value is approximately the value of a share of Apple stock plus the present value of the remaining coupons; this reflects that this note is virtually certain to convert into Apple stock at maturity as a result of the recent decline in Apple's stock price. As of April 24, 2013, the notes were worth approximately 64.41% of their face value or approximately \$451.31 per \$700.71 note.

Table 1: Value of UBS's \$700.71 September 26, 2012 Apple-linked SO Reverse Convertible

	2012		2013		
	September 21	September 26,	January 23	January 24	January 25
Apple Stock Price	\$700.09	\$665.18	\$514.01	\$450.50	\$439.88
Value	\$671.59	\$657.81	\$571.38	\$511.14	\$495.61
Bond Component	\$745.59				
Option Component	-\$74.01				
% of Offering Price	95.8%	93.88%	81.54%	72.95%	70.73%

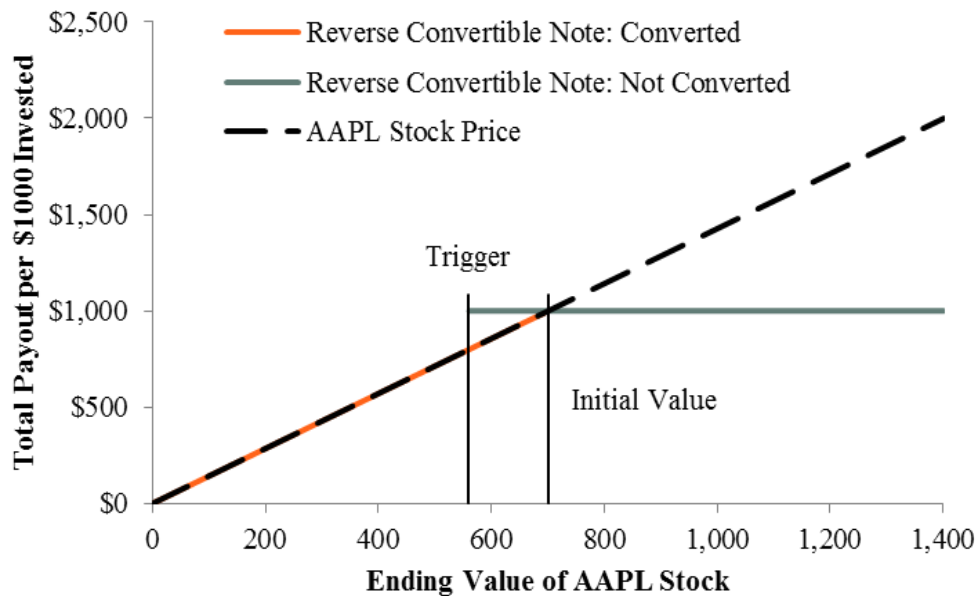
B. Reverse Convertibles

Reverse convertibles without the “SO”-qualifier might be aptly called Interim-Risk reverse convertibles but are typically just called reverse convertibles. Like SO reverse convertibles, they pay investors fixed coupons but make a maturity payment that depends on the closing price of the underlying security on every day between the pricing date and the valuation date.

Barclay's September 26, 2012 Apple-linked Reverse Convertible

Consider for example, the Reverse Convertibles Notes linked to Apple Inc. issued by Barclays on September 26, 2012.⁴ These notes are quite similar to the UBS notes issued the same day except they mature a day earlier, on September 25, 2013 instead of September 26, 2013 and pay an 8.50% annual coupon instead of an 8.03% annual coupon. If Apple closes below \$560.57 (80% of the Initial Price, approximately Apple's closing price on the Pricing Date) on *any* date prior to the Valuation Date, September 21, 2013, at maturity Barclays will pay investors the value of 1.427 shares of Apple stock or \$1,000, whichever is lower. The payoffs to this note are illustrated in Figure 5.

⁴ SLCG's Structured Product Research Report for this security can be found at www.slcg.com/pdf/tearsheets/06741JR76.pdf. Barclay's SEC filing can be found at www.sec.gov/Archives/edgar/data/312070/000119312512401729/d417526d424b2.htm.

Figure 5: Maturity Payoff to Barclays' September 26, 2012 Apple-linked Reverse Convertible


An investor who bought and held a one-year Barclays bond paying 8.50% coupons and sold a one-year short, down-and-in, at-the-money European put option with a \$560.57 trigger price would receive the quarterly coupons and at maturity would receive \$1,000 (the note's face value) minus 1.427 times the amount, if any, by which Apple's closing price is less than \$700.71 (payoff to the short put option) if Apple's stock price ever closed below \$560.57 during the term of the note.

On September 21, 2012 when Barclays set the terms of this note, a one-year Barclays bond paying 8.50% coupon was worth \$1,067.74 and the down-and-in put option was worth -\$112.32. Thus, this Barclays Apple-linked note was worth \$953.42 or 95.34% of face value. A few days later when the note was actually issued, Apple's stock price had already declined 5% to \$665.18 and the note was worth only \$916.97 or 91.70% of face value when it was issued.

At Apple's \$514.01 closing price on January 23, 2013, the note was worth \$778.60 or 77.86% of face value. At Apple's \$450.50 closing price on January 24, 2013, the note was worth \$696.47 or 69.65% of face value. This note's value fell over 8% because of Apple's disappointing earnings announcement after the close on January 23,

2013. As of April 24, 2013, the notes were worth approximately 61.49% of face value or \$614.95 per note.

Table 2: Value of Barclays' \$1,000 September 26, 2012 Apple-linked Reverse Convertible

	2012		2013		
	September 21	September 26,	January 23	January 24	January 25
Apple Stock Price	\$700.09	\$665.18	\$514.01	\$450.50	\$439.88
Value	\$953.42	\$916.97	\$778.60	\$696.47	\$674.94
Bond Component	\$1,067.74				
Option Component	-\$112.32				
% of Offering Price	95.3%	91.70%	77.86%	69.65%	67.49%

C. Autocallable Reverse Convertibles

Autocallable securities are superficially distinct from the reverse convertibles just described but are just another type of reverse convertibles. Autocallable securities have one or more call dates on which the structured product must be called by the issuer at a pre-specified premium if the reference asset's value has crossed a pre-specified trigger. The call dates tend to be contract anniversaries and the premiums to face value paid when the security is called increase with successive call dates.

Like reverse convertibles, autocallable reverse convertibles' payoffs at maturity expose investors to the reference asset's risk of capital loss without the reference asset's capital appreciation. Like the single observation reverse convertibles discussed above, some autocallable reverse convertibles' payoffs at maturity depend only on the reference asset's value on the note's final valuation date. Other autocallable reverse convertibles have payoffs that depend on the reference asset's lowest value during the note's term. Most of the autocallable reverse convertibles linked to Apple in our database have an added complication in that not only the maturity payment but also the coupons payments are contingent on the daily closing price of the linked asset.

91 of the 96 autocallables linked to Apple issued in the first 6 months of 2012 in our database have been called.

**UBS's September 26, 2012 Apple-linked Trigger Phoenix Autocallable
Optimization Securities linked to Apple Inc.**

In addition to the SO reverse convertible linked to Apple discussed above, UBS also issued \$150,000 of Trigger Phoenix Autocallable Optimization Securities linked to Apple Inc. on September 26, 2012 at \$10 per note.⁵

On the bi-monthly coupon observation date, if the notes are not called back, they pay either bi-monthly coupon at an annualized rate of 11.76% if Apple's stock price closes above the coupon barrier \$595.60, or no coupon for that period if Apple's stock price closes below \$595.60 on the coupon observation date.

UBS will redeem these autocallable notes if Apple's stock price on any bi-monthly call observation date after November 21, 2012 exceeds the initial stock price \$700.71. In that case, investors are repaid the \$10 face value plus the final coupon. At maturity, the notes convert into 0.01 share of Apple, Inc.'s stock in this case—if the market value of the reference stock at the note's maturity is below the trigger price \$595.60 (85% of the initial price on September 21, 2012). Otherwise, investors will receive the \$10 face value.

This note can be viewed as a combination of a zero-coupon note from UBS, a series of contingent coupon payments, and a short put option on the reference asset. For reasonable valuation inputs this note was worth \$9.59 per \$10 face value when its terms were set on September 21, 2012. This value is the sum of the \$9.93 present value of a zero-coupon note, *minus* \$0.68 for the short put options worth, *plus* \$0.34 for the present value of all future contingent coupon payments. When this note was actually issued on September 26, 2012, Apple had already declined 5% to \$665.18 and the notes were worth \$9.18 per \$10 face value.

At Apple's \$514.01 closing price on January 23, 2013, this UBS autocallable note linked to Apple was worth \$7.39 or 73.86% of face value. At Apple's \$450 closing price on January 24, 2013, the note was worth \$6.41 or 64.09% of face value. The value of

⁵ SLCG's Structured Product Research Report for this security can be found at www.slcg.com/pdf/tearsheets/90270B471.pdf. UBS's SEC filing can be found at www.sec.gov/Archives/edgar/data/1114446/000111444612011790/stp603560f_1fwp.htm.

this note fell 13.4% because of Apple's disappointing earnings announcement after the close on January 23, 2013. As of April 24, 2013, the notes were worth about \$5.72 per \$10 face value.

Table 3: Value of UBS' \$10 September 26, 2012 Apple-linked Trigger Phoenix Autocallable

	2012		2013		
	September 21	September 26,	January 23	January 24	January 25
Apple Stock Price	\$700.09	\$665.18	\$514.01	\$450.50	\$439.88
Value	\$9.59	\$9.18	\$7.39	\$6.41	\$6.24
Bond Component	\$10.27				
Option Component	-\$0.68				
% of Offering Price	95.90%	91.83%	73.86%	64.09%	62.44%

IV. Conclusion

We have written extensively about structured products, especially reverse convertibles. Investors in the 283 Apple-linked structured products we value on a daily basis lost \$37.6 million or over 10% of their value on January 24, 2013. Due to the continued decline in Apple's stock price, the 283 products have lost an additional \$37 million in market value through April 24, 2013. The rise and fall of Apple provides an additional cautionary tale on the risk of reverse convertibles.