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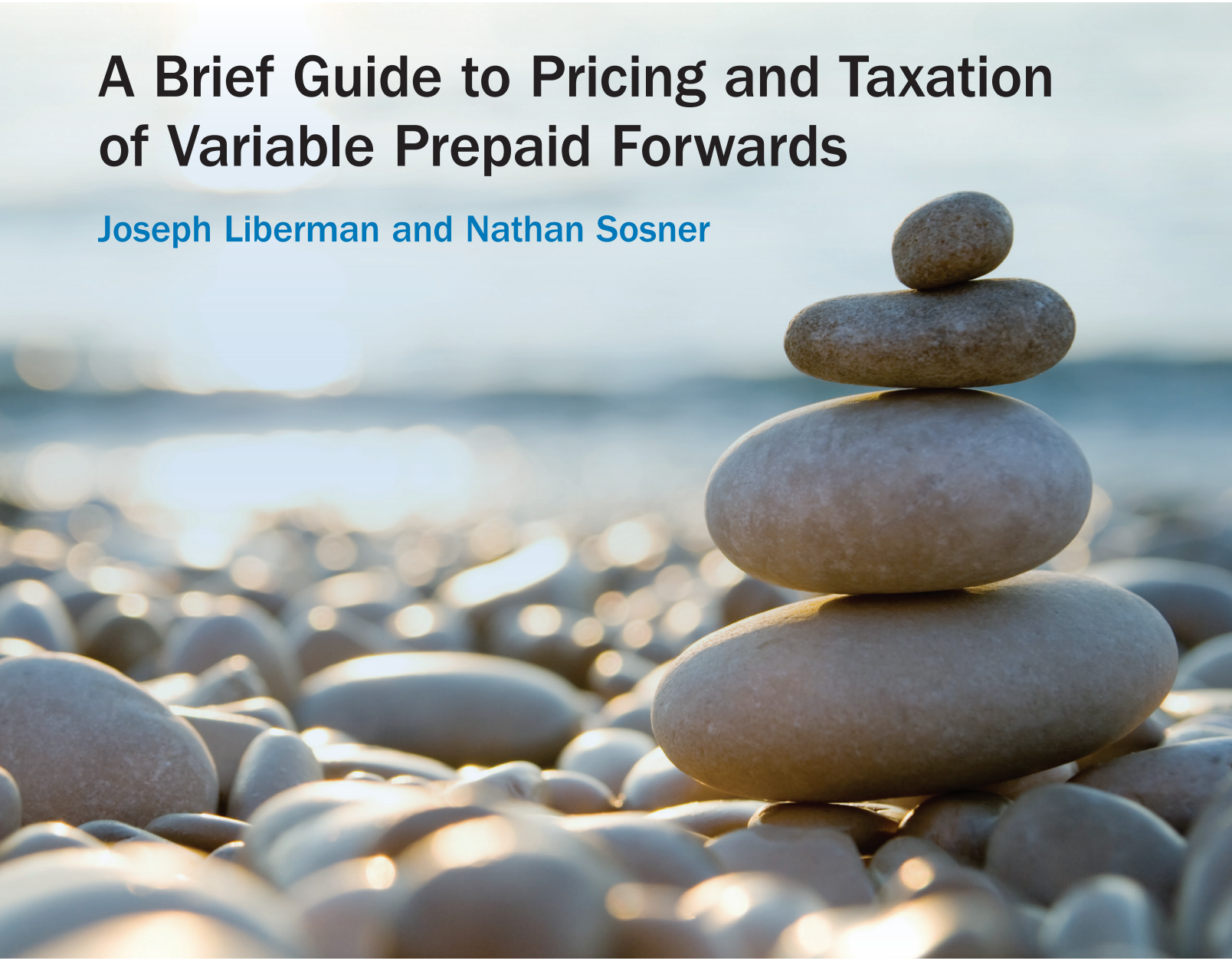
A Brief Guide to Pricing and Taxation of Variable Prepaid Forwards

Joseph Liberman and Nathan Sosner



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KEY FINDINGS

- Using options pricing theory, we develop a variable prepaid forward (VPF) pricing model that helps understand the VPF prepayment amount and the cash flows and tax liabilities upon VPF rolls.
- Depending on the circumstances, a VPF can offer a prepayment exceeding 90% of the value of the stock committed to the contract, with the VPF floor having a major impact on the prepayment amount.
- While rolling a VPF may generate a positive cash flow for the investor for some price ranges, it can be very costly when the stock price declines significantly—which is the very scenario from which the investor seeks protection by entering into the VPF contract in the first place.

ABSTRACT

Variable prepaid forward (VPF) contracts have been developed as a solution to hedging the risk of concentrated, low-basis stock. Using options pricing theory, we develop a VPF pricing model that helps understand the VPF prepayment amount and the cash flows and tax liabilities upon VPF rolls. We also provide a detailed discussion of the application of tax straddle rules to VPF transactions. We show that, depending on the circumstances, a VPF can offer a prepayment exceeding 90% of the value of the stock committed to the contract, with the VPF floor having a major impact on the prepayment amount. While for some price ranges, rolling a VPF may generate a positive cash flow for the investor, we find that rolling a VPF can be very costly when the stock price declines significantly—which is the very scenario from which the investor seeks protection by entering into the VPF contract in the first place.

Variable prepaid forward (VPF) contracts have been developed as a solution for hedging the risk of concentrated, low-basis stock.[1] The key feature of the VPF contract is that its inception does not constitute either an outright or a

[1] For further discussion of the strategies for diversifying concentrated, low-basis stock, see, for example, Welch (1999, 2001, 2002, 2003), Kiefer (2000), Miller (2002), Boyle et al. (2004), Quisenberry and Welch (2005), Brunel (2006), Gordon (2009), Lucas (2020), Goldberg, Cai, and Selwitz (2022), and Bouchey (2024).

constructive sale of the stock,[2] and, as a result, does not trigger recognition of the stock's built-in gain.

VPF is a relatively simple contract where an investor pledges a stock as collateral for a fixed term and, in return, receives a substantial fraction of the stock's current value in cash. Depending on the stock and the terms of the VPF contract, this cash amount, often referred to as *prepayment*, can exceed 90 cents on the dollar. During the life of the contract, the investor receives dividends on the stock up to a pre-specified amount, typically anchored to the current level of dividend per share. There are no other exchanges of cash flows until the VPF maturity. All taxes, except those paid on the stock's dividends, are deferred until the VPF maturity.

VPF is an appealing solution from both pre-tax and tax perspectives. From a pre-tax standpoint, a VPF offers three key benefits. First and foremost, it provides downside protection. Second, it allows investors to participate in some of the stock's upside potential. Finally, it immediately generates a significant amount of cash proceeds from the prepayment that investors can deploy toward diversifying their investment portfolios or for any other purpose. From a tax perspective, a VPF allows investors to defer the recognition of gains to a later date, even while receiving cash proceeds today.

Despite these numerous advantages, VPF transactions are not without challenges. The main problem with VPFs is the potential tax liability that the investor faces upon the contract's maturity, when most of the VPF prepayment turns into a realized capital gain.[3] As a result, it has long been recognized that the liquidity provided by a VPF is not the end of the journey, but rather the first step toward a comprehensive financial solution.[4]

In this article, we focus on the economics of VPF contracts, the legal authority upon which they rely, and their taxation upon rolls and maturity. We revisit the topic of investing the liquidity unlocked by VPF transactions in Liberman and Sosner (2025).

THE ECONOMICS OF A TYPICAL VPF CONTRACT

Contract Structure

The VPF contract effectively functions as a loan secured by a hedged stock position. The options hedge provides downside protection, allowing the VPF provider—such

[2] Under Internal Revenue Code (IRC) Section 1259, titled "Constructive sales treatment for appreciated financial positions," if a taxpayer holding an appreciated position enters into a short sale, an offsetting swap, futures, or forward contract, or one or more other transactions that have substantially the same effect as a short sale, or an offsetting swap, futures, or forward contract on the same or substantially identical property, the taxpayer shall recognize gain as if such an appreciated position were sold. In simpler terms, a constructive sale means that when an investor holding low-basis stock hedges it with a short sale of the stock or with a delta-one derivative (or a delta-one portfolio of derivatives) on the stock, the investor's unrealized gain in the stock will be fully recognized as if the stock were sold outright.

[3] In theory, to defer this gain realization, a VPF can be "rolled" at or prior to maturity. As discussed further below, rolling a VPF contract requires a high level of expertise and might result in large cash outlays if the stock value either increases substantially or declines. Note, however, that a decline in value is the very issue the investor looks to address by entering into the VPF in the first place.

[4] In an article published more than two decades ago, Welch (2001) quotes Brent Bunger, a principal at Legacy Capital Group, who remarked, "We rarely use the variable-forward trade as a standalone transaction. We use it as an important step in a more comprehensive overall wealth-management plan. We have developed some very creative investment- and tax-management strategies for high-net-worth clients, and the variable prepaid forward frequently is the transaction that allows us to unlock the liquidity in a low-basis position." Farr (2004) goes so far as to say, "Some research suggests that immediate diversification is superior to monetization techniques such as a variable pre-paid forward transaction—unless the proceeds from the monetization are invested in a tax efficient investment strategy."

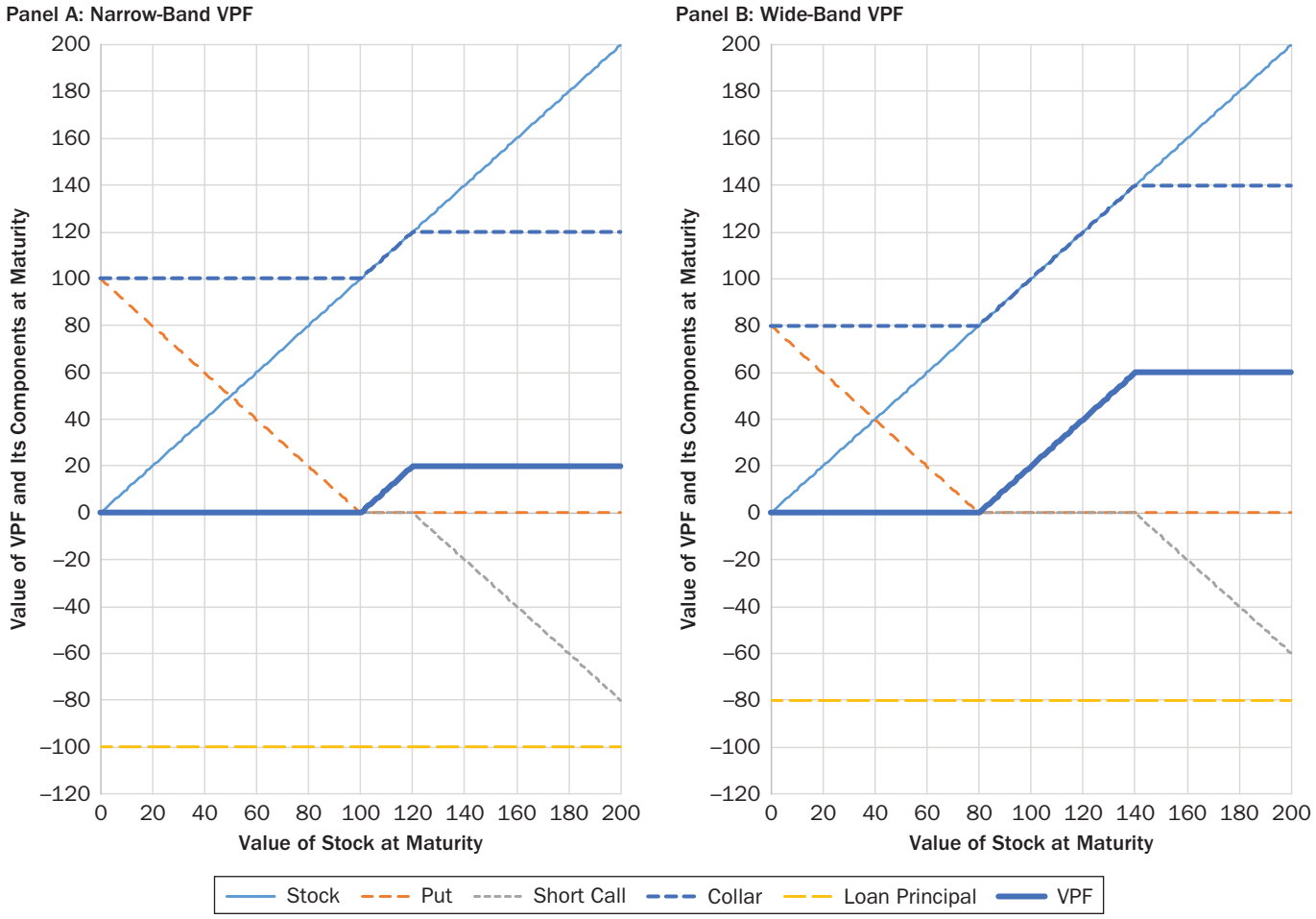
as a bank—to issue a larger loan against the concentrated stock pledged as collateral. The contract's payoff at maturity implicitly comprises four components: the stock, a put option on the stock, a call option on the stock, and a loan. Let's review these components one at a time. We will use Exhibit 1, which shows payoffs at VPF maturity, to facilitate the discussion. Panels A and B describe a narrow-band and a wide-band VPF, respectively.

For the duration of the VPF contract, the investor retains ownership of the pledged stock, including the right to vote and receive dividends on the pledged shares. Typically, the dividend received by the investor is capped at the stock's dividend per share at the contract's inception. Since the investor owns the stock, the effect of the stock position on the value of the VPF changes one-for-one with the value of the stock. This effect is identical for the narrow-band and wide-band VPFs shown in Panels A and B, respectively.

The second component of the VPF is an implicit put option. Let's assume that the value of the pledged stock position is $100. The VPF shown in Panel A protects against any decline in the position value below its current value of $100. Effectively, an investor purchases an at-the-money put option with a strike of $100 that provides a full downside protection. On the other hand, the VPF in Panel B only hedges the drop

EXHIBIT 1

Payoffs at Maturity on the VPF Contract and Its Components



NOTES: All values are in USD. The stock's value at the VPF's inception is $100.

in the position value below $80, which corresponds to purchasing an out-of-the-money put option with a strike of $80.

The third component of the VPF is an implicit call option. An investor foregoes participation in the stock appreciation beyond a specific threshold. This corresponds to shorting an out-of-the-money call option. This implicit short call position helps pay for the implicit put option component we just discussed. In the narrow-band VPF scenario, the call option has a $120 strike, while in the wide-band scenario, it has a $140 strike.

The combination of long stock, long put, and short call is typically referred to as an options *collar*, where the put strike represents a *floor* and the call strike represents a *cap* of the collar. An investor holding an options collar only participates in the performance of the stock between the floor and the cap. The thick dotted line in Exhibit 1 shows the options collar payoff at VPF maturity. The narrow-band VPF in Panel A has a floor at $100 and a cap at $120, while the wide-band VPF in Panel B has a floor and a cap at $80 and $140, respectively.

The fourth and final component of the payoff at maturity is the repayment of the loan principal to the bank. In both the narrow-band VPF in Panel A and the wide-band VPF in Panel B, the loan principal is equal to the fully protected amount, which is the options collar floor. In the narrow-band VPF, this amounts to $100, while in the wide-band VPF, it is $80.

Summing up the value of the stock, the long put option, the short call option (which, in aggregate, form an options collar), and the loan principal repayment, we obtain the VPF payoff at maturity. In Exhibit 1, this payoff is represented by the thick solid blue line. Understanding the components of the VPF payoff at maturity will allow us to develop a VPF pricing model. The model will determine the amount of prepayment that the investor will be able to receive at the contract's inception, as well as the amount the investor would have to pay to settle the VPF in cash at or prior to maturity. In the Appendix, we discuss the legal authority for VPF contracts structured in way described in this section.

Physical and Cash Settlement of a Contract

Although the VPF can be cash settled before maturity, here, for simplicity, we only show an example of settlement at maturity. The investor has a choice between settling the VPF physically (that is, with shares of the stock) or in cash. Let's review how the VPF payoffs at maturity can be used to determine the amount of either shares or cash that the investor must deliver to the bank at the settlement of the contract.

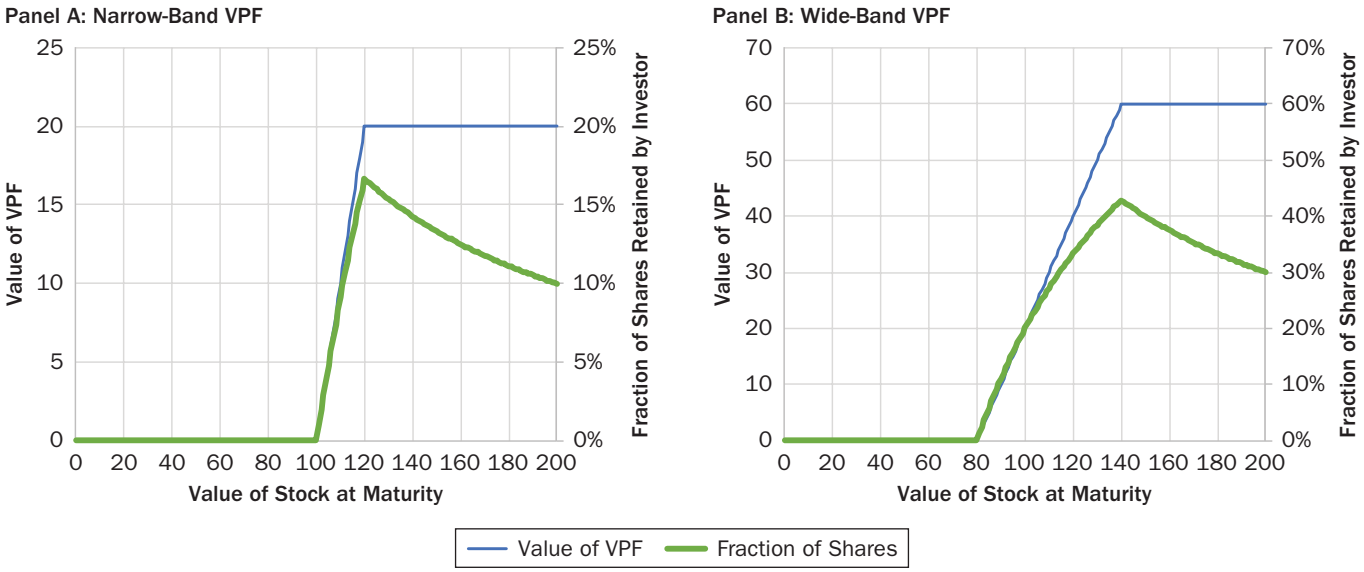
Exhibit 2 illustrates physical settlement. When choosing physical settlement, the investor delivers either all or a fraction of the shares to the bank while retaining the rest. The specific fractions of shares to be delivered and retained are determined by translating the VPF payoff into shares of the stock.[5]

For the narrow-band VPF in Exhibit 2, Panel A, the investor's payoff at maturity is zero if the stock position value is below $100. This means that the investor must deliver all the shares to the bank to settle the contract. When the stock position value surpasses $100, the investor begins to participate in the stock's appreciation. For example, when the stock's value is $120, the VPF payoff is $20. This means the investor retains $20 out of $120, or 16.67% of the shares (calculated as 20/120), while the rest of the shares are delivered to the bank. As the stock's value continues to rise beyond $120, the investor still retains $20 worth of shares. Given that the

[5] Delivery of shares to the bank is a permanent transfer of ownership from the investor to the bank at the settlement of the VPF. This should not be conflated with the investor depositing shares at the bank at the VPF's inception as collateral for the contract. The shares deposited as collateral remain fully owned by the investor until they are delivered to the bank upon settlement.

EXHIBIT 2

Physical Settlement at the VPF Maturity: Fraction of Shares Retained by the Investor



NOTES: All values are in USD. The stock's value at the VPF's inception is $100.

stock value increases, this translates into a progressively smaller fraction of shares retained by the investor.

The same logic applies to the wide-bound VPF in Exhibit 2, Panel B. The investor forfeits all shares if the stock's value is below $80 and starts participating when the stock's value rises above $80. For instance, when the stock's value is $140, the VPF payoff is $60, allowing the investor to retain 42.86% of the shares (calculated as 60/140), while the rest is delivered to the bank.

Exhibit 3 shows the payment that must be made to the bank if the investor chooses to settle in cash instead of stock. In this case, the investor retains 100% of the stock position and makes a cash payment to the bank. The cash payment consists of the components shown in Exhibit 1 and corresponds to repaying the loan, receiving the payment on the long put, and making the payment on the short call. Note that, while we are showing an example of cash settlement at maturity, the investor has the option to terminate the contract through cash settlement at any point before maturity.

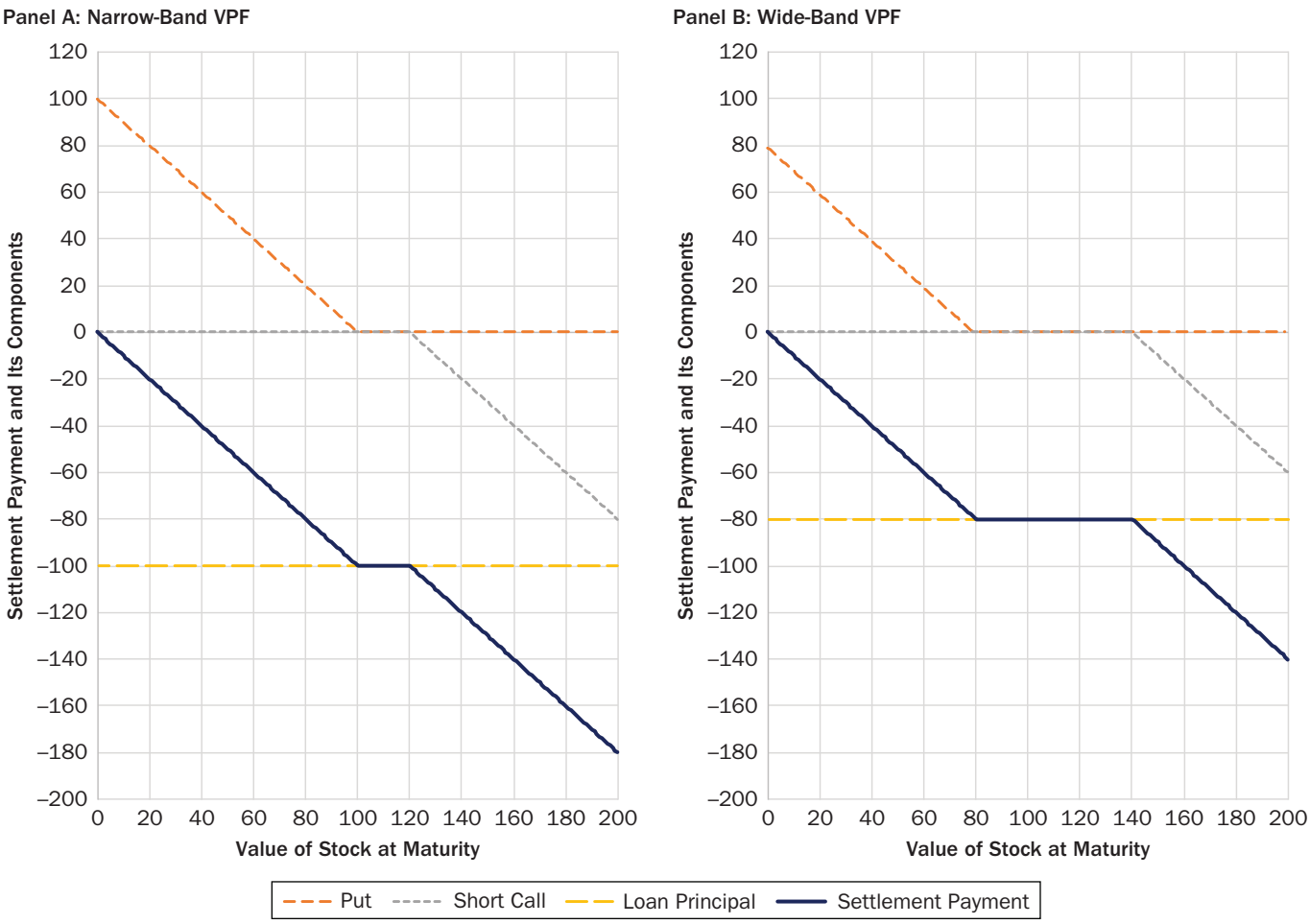
Now, let's consider the narrow-band VPF shown in Exhibit 3, Panel A. First, the investor must pay back the loan principal, which in this case amounts to $100. If the stock's value is below $100, the investor receives a positive payoff from the long put position, which reduces the settlement payment. If, on the other hand, the stock's value is above $120, the investor must cover a loss on the short call position, which increases the settlement payment. The thick line in the exhibit represents the total cash settlement payment made by the investor at the VPF maturity. Exhibit 3, Panel B, shows the same calculation for the wide-band VPF. Note that, since the investor retains the entirety of the stock position, the value of the stock at maturity reduced by the settlement payment is identical to the value of the stock retained by the investor in the case of physical settlement.

A VPF PRICING MODEL

Using the VPF payoff structure described above, we now can price the VPF contract and calculate the prepayment received by the investor entering into the contract. We develop a simple model utilizing Black-Scholes option pricing formulas. We find that,

EXHIBIT 3

Cash Settlement at the VPF Maturity: Cash Payment Amount and Its Components



NOTES: All values are in USD. The stock's value at the VPF's inception is $100.

despite its simplicity, our model matches reasonably well the quotes we see from actual VPF providers.

Let S_t be the stock's value at time t, and q be the stock's dividend yield. An investor is looking to enter into a VPF contract on the stock with a T-year maturity, X_L floor, and X_H cap. The VPF contract payoff at maturity is given by

$$V_T(S_T, X_L, X_H) = S_T - X_L + P_T(S_T, X_L) - C_T(S_T, X_H) \quad (1)$$

where $P_T(S_T, X_L)$ is the put payoff at maturity and $C_T(S_T, X_H)$ is the call payoff at maturity. Note that Equation 1 simply aggregates the payoffs of the VPF components described graphically in Exhibit 1.

Using the VPF components summarized in Equation 1, we can calculate the present value of the contract at inception. Let $\Omega = \{q, r, \sigma(\kappa, \tau)\}$ be the set of exogenous market variables, where q is the stock's dividend yield, r is the prevailing interest rate, and $\sigma(\kappa, \tau)$ is the options volatility surface, with κ and τ denoting the option's strike price and time to expiration, respectively. The value of the VPF at inception can then be expressed as

$$V_0(S_0, X_L, X_H, T, \Omega) = e^{-qT}S_0 - e^{-rT}X_L + p_0(S_0, X_L, T, \Omega) - c_0(S_0, X_H, T, \Omega) \quad (2)$$

where $p_0(S_0, X_L, T, \Omega)$ and $c_0(S_0, X_H, T, \Omega)$ are the prices of European put and call options at the contract's inception.

As we have seen in Exhibit 1, the value that the investor derives from the VPF at maturity varies between zero and the difference between the cap X_H and the floor X_L. Equation 2 allows us to calculate the present value of this uncertain payoff at maturity.

The cash advance that the bank is willing to provide at the contract's inception is determined by the bank's payoff at the VPF maturity. At the VPF maturity, the bank receives the stock minus the value of the VPF contract at that time. This value should compensate the bank for committing its capital to the cash advance. In a competitive VPF market, the value at maturity should equal the cost of capital commitment. This is described by the following equation, where r stands for the prevailing interest rate and δ stands for the spread between the prevailing interest rate and the bank's cost of capital

$$A_0 e^{(r+\delta)T} = S_T - V_T(S_T, X_L, X_H) \tag{3}$$

where A_0 is the cash advance, or the VPF prepayment amount, provided to the investor at the contract's inception.

Substituting Equation 1 into Equation 3, we obtain

$$A_0 e^{(r+\delta)T} = X_L - P_T(S_T, X_L) + C_T(S_T, X_H) \tag{4}$$

The present value of the components in Equation 4 is given by

$$A_0 e^{\delta T} = e^{-rT} X_L - p_0(S_0, X_L, T, \Omega) + c_0(S_0, X_H, T, \Omega) \tag{5}$$

From Equation 5 we can derive the prepayment amount as

$$A_0 = e^{-\delta T}\left[e^{-rT} X_L - p_0(S_0, X_L, T, \Omega) + c_0(S_0, X_H, T, \Omega)\right] \tag{6}$$

Using Equation 6 and Black-Scholes pricing formulas for the put and call options, we can calculate the prepayment amount.

Note also that the present value of the terms in Equation 3 is

$$A_0 e^{\delta T} = S_0 e^{-qT} - V_0(S_0, X_L, X_H, T, \Omega) \tag{7}$$

where $V_0(S_0, X_L, X_H, T, \Omega)$ is as defined in Equation 2. Equation 7 can be rearranged as

$$S_0 = S_0(1 - e^{-qT}) + A_0 + V_0(S_0, X_L, X_H, T, \Omega) + A_0(e^{\delta T} - 1) \tag{8}$$

Equation 8 has the following interpretation. The investor gives up on the stock position valued at S_0. The value of the foregone position covers: (a) the present value of the stream of dividends until maturity, (b) the prepayment amount, (c) the present value of the future payoff up to the difference between the VPF cap and floor, and (d) the present value of the financing cost, which increases with the prepayment amount, the bank financing spread, and the time to maturity.

A NUMERICAL EXAMPLE

Consider the narrow-band and wide-band VPF contracts described in Exhibit 1. Assume that the prevailing interest rate, r, is 3%; the bank financing spread, δ, is 1.5% (resulting in the bank's cost of capital of 4.5%); the stock's volatility is 50%; the stock's dividend yield is 0%; and the term of the VPF is two years.

The narrow-band VPF has a floor of \$100 and a cap of \$120. Using Black-Sholes pricing formulas, we calculate the put and call values as \$24.01 and \$23.35, respectively. The present value of the floor is $\$100 \times e^{-3\%\times 2} = \$94.18$. The terms in square brackets in Equation 6 add up to \$93.51. Applying the bank financing spread of 1.5%, we obtain the prepayment amount of $\$93.51 \times e^{-1.5\%\times 2} = \$90.75$. The maximum payoff the investor gets at maturity is \$20. From Equation 2, the present value of the VPF is \$6.49, and, from Equation 8, the financing cost is \$2.76. Since the stock is not a dividend-paying stock, and thus there is no stream of dividends for which to account, the prepayment, the VPF value, and the financing cost add up to the value of the stock of \$100.

For the wide-band VPF with a floor of \$80 and a cap of \$140, the Black-Scholes put and call values are \$13.72 and \$18.41, respectively. The present value of the floor is $\$80 \times e^{-3\%\times 2} = \$75.34$. The terms in square brackets in Equation 6 add up to \$80.03. Applying the bank financing spread, we obtain the prepayment amount of $\$80.03 \times e^{-1.5\%\times 2} = \$77.67$. The maximum payoff the investor gets at maturity is \$60. From Equation 2, the present value of the VPF is \$19.97, and, from Equation 8, the financing cost is \$2.37. The prepayment, the VPF value, and the financing cost add up to the value of the stock of \$100.

Equations 6 and 8, along with the example above, help demystify the calculation of the VPF prepayment amount and the VPF financing cost. Equation 6 also explains why prepayment is so sensitive to the options collar floor, which is determined by the implied put strike. A VPF is designed to fully protect the loan principal through the options collar. Thanks to the put option protection, the value of the hedged stock position at maturity cannot fall below the collar floor. As a result, the loan principal is set to be exactly equal to the collar floor.

Exhibit 4 provides additional data points for our example. We maintain the same assumptions as above but modify the floor and cap of the VPF. (The numbers matching the example above are highlighted.) As the VPF band widens due to a reduction in the floor and an increase in the cap, the prepayment amount decreases. This decline in the prepayment amount naturally results in a lower financing cost. On the other hand, the investor's maximum upside participation in the stock's performance increases, leading to a higher present value of the VPF. Exhibit 4 makes it clear that the dividend stream, the prepayment, the present value of the VPF, and the financing cost always add up to the stock value, as shown in Equation 8.

As seen in Exhibit 4, an investor interested in a larger prepayment amount should be considering VPFs with narrower bands between the cap and floor. However, a larger prepayment comes with a cost: a narrow-band VPF limits the maximum value of the stock retained by the investor (see the third column in Exhibit 4). Exhibit 5 shows that an investor optimistic about the stock's prospects can retain the same maximum value of the stock as with the wide-band VPF and, at the same time, increase the

EXHIBIT 4

Effect of the VPF Floor and Cap on Prepayment, Present Value, and Financing Cost

VPF Floor (Put Strike)	VPF Cap (Call Strike)	Maximum Retention	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
100	120	20	24.01	23.35	0.00	**90.75**	6.49	2.76
90	130	40	18.57	20.71	0.00	84.33	13.10	2.57
80	140	60	13.72	18.41	0.00	**77.67**	19.97	2.37
70	150	80	9.53	16.40	0.00	70.64	27.21	2.15
60	160	100	6.08	14.63	0.00	63.14	34.94	1.92
50	170	120	3.42	13.08	0.00	55.07	43.25	1.68

NOTES: All values are in USD. The stock's value at the VPF's inception is \$100. The two highlighted cells will serve as anchor points for Exhibits 5 to 11.

EXHIBIT 5

Increasing Prepayment by Increasing the VPF Floor

VPF Floor (Put Strike)	VPF Cap (Call Strike)	Maximum Retention	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
50	110	60	3.42	26.37	0.00	67.96	29.97	2.07
60	120	60	6.08	23.35	0.00	71.59	26.23	2.18
70	130	60	9.53	20.71	0.00	74.82	22.90	2.28
80	140	60	13.72	18.41	0.00	**77.67**	19.97	2.37
90	150	60	18.57	16.40	0.00	80.14	17.42	2.44
100	160	60	24.01	14.63	0.00	82.29	15.20	2.51

NOTES: All values are in USD. The stock's value at the VPF's inception is $100. The highlighted cell matches the value in Exhibit 4.

EXHIBIT 6

Sensitivity of the VPF Prepayment to the Prevailing Interest Rate

Interest Rate	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
Panel A: Narrow-Band VPF						
0%	27.63	21.36	0.00	90.95	6.28	2.77
3%	24.01	23.35	0.00	**90.75**	6.49	2.76
6%	20.77	25.41	0.00	90.57	6.67	2.76
9%	17.90	27.55	0.00	90.42	6.83	2.75
12%	15.36	29.75	0.00	90.30	6.95	2.75
15%	13.12	31.99	0.00	90.21	7.04	2.75
Panel B: Wide-Band VPF						
0%	16.04	16.65	0.00	78.23	19.39	2.38
3%	13.72	18.41	0.00	**77.67**	19.97	2.37
6%	11.68	20.26	0.00	77.18	20.47	2.35
9%	9.90	22.20	0.00	76.79	20.87	2.34
12%	8.35	24.23	0.00	76.48	21.19	2.33
15%	7.01	26.32	0.00	76.26	21.42	2.32

NOTES: All values are in USD. The stock's value at the VPF's inception is $100. The highlighted cells match the values in Exhibit 4.

prepayment amount. For example, by setting the floor and cap at $100 and $160, respectively, the investor retains $60 of the stock if the stock's value is $160 or above and obtains a prepayment of $82.29, rather than $77.67 under the 80–140 VPF.[6]

Exhibits 6 to 11 further explore the sensitivity of the prepayment amount to various parameters in our model. Panels A and B of the exhibits show the narrow-band 100–120 and the wide-band 80–140 VPF, respectively.

Exhibit 6 shows that the sensitivity to the prevailing interest rate level is low. The prepayment amounts are quite similar for interest rates in the 0% to 15% range, especially for the narrow-band VPF. The sensitivity of the prepayment amount to the bank financing spread is substantially higher than to the interest rate. As demonstrated in Exhibit 7, with the time to maturity held constant at two years, even a small increase in the financing spread results in a significant increase in the financing cost and a reduction in the prepayment amount.

Exhibit 8 shows that holding the financing spread fixed at 1.5% and increasing the time to maturity leads to a somewhat lower prepayment amount for the narrow-band VPF, but not for the wide-band VPF, as the higher financing cost is offset by the reduction

[6] The consideration here is that the 80–140 VPF investor retains $60 when the stock's value is $140 or above, while the 100–160 VPF investor only retains $60 when the stock's value is $160 or above. This effect is reflected in the reduction in the present value of the VPF (see the penultimate column in Exhibit 5).

EXHIBIT 7

Sensitivity of the VPF Prepayment to the Bank Financing Spread

Financing Spread	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
Panel A: Narrow-Band VPF						
0.5%	24.01	23.35	0.00	92.58	6.49	0.93
1.0%	24.01	23.35	0.00	91.66	6.49	1.85
1.5%	24.01	23.35	0.00	**90.75**	6.49	2.76
2.0%	24.01	23.35	0.00	89.85	6.49	3.67
2.5%	24.01	23.35	0.00	88.95	6.49	4.56
3.0%	24.01	23.35	0.00	88.07	6.49	5.45
Panel B: Wide-Band VPF						
0.5%	13.72	18.41	0.00	79.24	19.97	0.80
1.0%	13.72	18.41	0.00	78.45	19.97	1.58
1.5%	13.72	18.41	0.00	**77.67**	19.97	2.37
2.0%	13.72	18.41	0.00	76.89	19.97	3.14
2.5%	13.72	18.41	0.00	76.13	19.97	3.90
3.0%	13.72	18.41	0.00	75.37	19.97	4.66

NOTES: All values are in USD. The stock's value at the VPF's inception is $100. The highlighted cells match the values in Exhibit 4.

EXHIBIT 8

Sensitivity of the VPF Prepayment to the Time to Maturity

Panel A: Narrow-Band VPF

Years to Maturity	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
0.5	13.20	7.86	0.00	92.48	6.82	0.70
1	18.01	14.10	0.00	91.75	6.86	1.39
1.5	21.39	19.09	0.00	91.23	6.70	2.08
2	24.01	23.35	0.00	**90.75**	6.49	2.76
2.5	26.14	27.10	0.00	90.28	6.27	3.45
3	27.92	30.47	0.00	89.81	6.05	4.13

Panel B: Wide-Band VPF

Term	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
0.5	4.65	4.06	0.00	77.64	21.78	0.58
1	8.49	9.46	0.00	77.44	21.39	1.17
1.5	11.39	14.21	0.00	77.53	20.70	1.76
2	13.72	18.41	0.00	**77.67**	19.97	2.37
2.5	15.65	22.19	0.00	77.79	19.24	2.97
3	17.30	25.64	0.00	77.87	18.54	3.58

NOTES: All values are in USD. The stock's value at the VPF's inception is $100. The highlighted cells match the values in Exhibit 4.

in the present value of the VPF. However, the financing spread typically increases with the VPF's term to maturity, amplifying the financing cost of longer-dated VPFs and leading to a reduction in their prepayment amounts, as we observed in Exhibit 7.

Further, as shown in Exhibit 9, assuming a flat volatility surface, an increase in stock volatility reduces the present value of the VPF and increases the prepayment amount, particularly for the wide-band VPF. In contrast, as seen in Exhibit 10, holding the call option implied volatility constant at 50% and increasing the volatility skew (the difference between the implied volatility of the put and call options implicit in the VPF contract) has a negative impact on the prepayment amount.

Finally, Exhibit 11 shows that a higher stock dividend yield increases the put price and reduces the call price, which results in a lower prepayment amount.

EXHIBIT 9

Sensitivity of the VPF Prepayment to the Stock Volatility

Stock Volatility	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
Panel A: Narrow-Band VPF						
30%	13.56	12.11	0.00	89.99	7.27	2.74
40%	18.83	17.75	0.00	90.35	6.90	2.75
50%	24.01	23.35	0.00	**90.75**	6.49	2.76
60%	29.07	28.84	0.00	91.17	6.06	2.78
70%	33.98	34.18	0.00	91.59	5.62	2.79
80%	38.73	39.36	0.00	92.00	5.20	2.80
Panel B: Wide-Band VPF						
30%	5.49	7.46	0.00	75.02	22.69	2.28
40%	9.51	12.81	0.00	76.32	21.35	2.32
50%	13.72	18.41	0.00	**77.67**	19.97	2.37
60%	17.97	24.04	0.00	79.01	18.58	2.41
70%	22.17	29.61	0.00	80.34	17.21	2.45
80%	26.27	35.05	0.00	81.64	15.88	2.49

NOTES: All values are in USD. The stock's value at the VPF's inception is $100. The highlighted cells match the values in Exhibit 4.

EXHIBIT 10

Sensitivity of the VPF Prepayment to the Stock Volatility Skew

Put Implied Volatility	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
Panel A: Narrow-Band VPF						
50%	24.01	23.35	0.00	**90.75**	6.49	2.76
55%	26.56	23.35	0.00	88.28	9.03	2.69
60%	29.07	23.35	0.00	85.84	11.55	2.61
65%	31.55	23.35	0.00	83.43	14.02	2.54
70%	33.98	23.35	0.00	81.07	16.46	2.47
75%	36.38	23.35	0.00	78.74	18.86	2.40
Panel B: Wide-Band VPF						
50%	13.72	18.41	0.00	**77.67**	19.97	2.37
55%	15.84	18.41	0.00	75.60	22.09	2.30
60%	17.97	18.41	0.00	73.55	24.21	2.24
65%	20.07	18.41	0.00	71.50	26.32	2.18
70%	22.17	18.41	0.00	69.47	28.41	2.12
75%	24.23	18.41	0.00	67.46	30.48	2.05

NOTES: All values are in USD. The stock's value at the VPF's inception is $100. The highlighted cells match the values in Exhibit 4.

VPF TAXATION AND THE APPLICATION OF STRADDLE RULES

While a properly structured VPF contract does not trigger a taxable sale at its inception, it does create a tax straddle. Internal Revenue Code (IRC) Section 1092(c)(2)(A) defines a tax straddle as two "offsetting" positions in the same or related property, where one position substantially diminishes the risk of loss of the other. Consequently, a VPF designed to protect the investor from losses on the stock position is, by definition, a tax straddle.

There are two adverse consequences of straddle rules that are relevant for our purposes: loss deferral and termination of the holding period, unless the position that becomes part of the straddle is already a long-term position.

EXHIBIT 11

Sensitivity of the VPF Prepayment to the Stock Dividend Yield

Dividend Yield	Put Price	Call Price	Stream of Dividends	Prepayment	VPF Present Value	Financing Cost
Panel A: Narrow-Band VPF						
0.0%	24.01	23.35	0.00	**90.75**	6.49	2.76
0.5%	24.34	22.78	1.00	89.88	6.39	2.74
1.0%	24.67	22.22	1.98	89.02	6.29	2.71
1.5%	25.01	21.68	2.96	88.16	6.20	2.68
2.0%	25.35	21.15	3.92	87.32	6.10	2.66
2.5%	25.68	20.62	4.88	86.48	6.01	2.63
Panel B: Wide-Band VPF						
0.0%	13.72	18.41	0.00	**77.67**	19.97	2.37
0.5%	13.95	17.93	1.00	76.98	19.68	2.34
1.0%	14.17	17.46	1.98	76.30	19.39	2.32
1.5%	14.40	17.00	2.96	75.63	19.11	2.30
2.0%	14.64	16.55	3.92	74.97	18.82	2.28
2.5%	14.87	16.11	4.88	74.32	18.54	2.26

NOTES: All values are in USD. The stock's value at the VPF's inception is $100. The highlighted cells match the values in Exhibit 4.

First, if one position in a straddle is liquidated at a loss while the offsetting position remains, the realized loss is disallowed to the extent of unrealized gain in the remaining position and is added to the basis of the remaining position. This defers the recognition of the loss until the remaining position is also liquidated. Conversely, if a position in a straddle is liquidated at a gain, the gain is recognized immediately. In summary, tax straddles defer losses while continuing to realize gains.

Second, if a VPF is issued against a stock with a long-term holding period (greater than one year), the stock retains its long-term treatment. However, if the stock is a short-term holding (one year or less), the stock's holding period is reset to zero and does not begin to accrue until the VPF matures or is liquidated. Similarly, the VPF itself, being part of a straddle, does not accrue a holding period.

Let us now see how straddle rules affect VPF taxation upon maturity or early termination. If we ignore settlement with unrelated stock, which is quite atypical, there are four VPF termination scenarios: physical settlement with a long-term stock position, physical settlement with a short-term stock position, cash settlement at a gain, and cash settlement at a loss.

The only difference between the first two cases is whether the stock position was long-term or short-term at the time of the VPF contract's inception. Based on the straddle rules we just reviewed, the long-term position remains long-term, while the holding period of a short-term position is reset to zero and does not accrue, irrespective of the VPF's term. As a result, the character of the gain upon physical settlement—long-term or short-term—is determined at the VPF's inception.

Whereas the *character* of gain is known at inception, the *amount* of gain is determined based on the number of shares delivered in physical settlement. For example, in Exhibit 2, we show the fraction of shares retained by the investor, with the remaining shares being delivered to the bank to close the contract. The gain recognized by the investor will be calculated as the prepayment amount minus the aggregate cost basis of the shares delivered to the bank.

If a VPF is settled in cash, the amount of capital gain or loss is calculated as the difference between the cash settlement payment and the prepayment amount. If the cash settlement exceeds the prepayment, the investor realizes a loss. Due to straddle rules, this loss is first recharacterized from short-term to long-term if the stock position was a long-term position at the VPF's inception. Then, the loss is

disallowed to the extent of the unrealized gain in the remaining stock position and added to the cost basis of the stock, thus reducing the gain recognized when the stock is disposed of in the future.[7]

If the cash settlement amount is less than the prepayment amount, the investor recognizes a short-term gain. The gain is always short-term because, under straddle rules, the VPF does not accrue a holding period.

Straddle rules create both character and timing disadvantages. Suppose, for example, that the stock position was a long-term position prior to the VPF's inception. A loss upon cash settlement results in a reduction of long-term capital gain when the stock is eventually sold, possibly in the distant future. In contrast, a gain upon cash settlement results in the immediate recognition of short-term capital gain.

ROLLING A VPF CONTRACT

Extending a VPF Contract: McKelvey versus Commissioner

Can a VPF contract be extended? The recent *McKelvey* case threw a wrench into investors' ability to extend a VPF contract (see *Estate of McKelvey v. Commissioner*, No. 17-2554 (2d Cir. 9/26/2018)). Here, we provide a brief summary of the case (see Blum and Stevens 2019 for a detailed description of the court cases). In September 2007, Andrew McKelvey entered into two 12-month VPFs on Monster Worldwide Inc. stock, maturing in September 2008. In July 2008, McKelvey extended the settlement dates of the VPFs until early 2010. McKelvey passed away in November 2008. His estate did not report any gain in 2008 as a result of the VPF extension.

The IRS contended that the extension should be treated as terminating the original contracts and entering into new ones, which should have triggered taxable events. Notably, the IRS did not dispute application of Revenue Ruling 2003-7 to the original contracts.

The McKelvey estate challenged the IRS's contention in Tax Court. In 2017, the Tax Court ruled in favor of McKelvey, concluding that the VPF extensions did not represent the termination of the original contracts and the origination of new ones, and therefore were not taxable events. The IRS appealed the Tax Court's decision, and in September 2018, the Second Circuit reversed the ruling, concluding that the extension did, in fact, constitute terminating the original contracts and entering into new ones, thus leading to taxable events.

Cash-Flow and Tax Implications of VPF Rolls

As a result of the Second Circuit ruling in the *McKelvey* case, it is prudent to avoid extending VPF contracts and instead "roll" them. A "roll" means terminating the original VPF contract via cash settlement and entering into a new VPF contract with a later maturity date. Furthermore, to prevent a constructive sale upon inception of the new VPF, the cap-floor band of the new contract should be adjusted to include the market price at the time of the roll (see Fichtenbaum and Gordon 2017 and 2019 for more on this point).

Rolling a VPF in a way favorable to the investor requires a high level of expertise. The timing of the roll and the terms of the new contract can significantly impact the pre-tax and after-tax economics of the roll. Rolling prior to maturity would require

[7] The gain recognized upon the stock disposition can be long-term or short-term, depending on the stock's holding period at the inception of the VPF contract.

repricing the original contract (using Equation 6) and settling it in cash. Effectively, in the cash settlement, the investor would sell the original put option back to the bank, buy the original call option back from the bank—both priced under current market conditions—and repay the loan to the bank. Here, for simplicity, we illustrate outcomes of rolling at VPF maturity when the options' payoffs are known with certainty.

Consider the example in Exhibit 12. Panels A and B show the narrow-band and wide-band VPF, respectively, from our previous examples. The stock's value and cost basis at the contract's inception are $100 and $0, respectively. The stock has 50% volatility and does not pay dividends. The stock position is a long-term position held by the investor for more than one year. The prevalent interest rate is 3% and the additional bank financing spread is 1.5%.

Exhibit 12 shows four scenarios of stock value at maturity. In the first scenario, the stock's value drops by 40% from its level at the VPF's inception. In the second scenario, the stock's value remains unchanged. In the remaining two scenarios, the stock's value increases by 40% and 300%, respectively.

Now, let's consider the cash settlement of the narrow-band VPF. As a reminder of our previous results, the VPF has a prepayment of $90.75. When the stock's value is $60, the long put option payoff is $40, the short call option expires worthless with a payoff of $0, and the loan principal repayment is $100, resulting in a total settlement payment of $60. On the other hand, when the stock's value is $400, the long put expires worthless, the investor owes $280 on the short call, and the total settlement payment, including the loan principal repayment, is $380.

Assuming that all the stock-specific and market variable parameter values remain constant, we use Equation 6 to calculate the prepayment on the new VPF with a floor at 100% and a cap at 120% of the stock's value at the time of the roll. The prepayment varies from $54.45 when the stock's value is $60 to $363.00 when the stock's value is $400. The net cash flow represents the difference between the prepayment received on the new VPF and the settlement amount paid on the original VPF.

EXHIBIT 12

Components of Cash Flows upon a VPF Roll

	Panel A: Narrow-Band VPF				Panel B: Wide-Band VPF			
Stock Value at Original VPF Maturity	$60.00	$100.00	$140.00	$400.00	$60.00	$100.00	$140.00	$400.00
Original VPF Prepayment Amount, (1)	$90.75	$90.75	$90.75	$90.75	$77.67	$77.67	$77.67	$77.67
Cash Settlement Payment Components								
Long Put	$40.00	$0.00	$0.00	$0.00	$20.00	$0.00	$0.00	$0.00
Short Call	$0.00	$0.00	($20.00)	($280.00)	$0.00	$0.00	$0.00	($260.00)
Return of Loan Principal	($100.00)	($100.00)	($100.00)	($100.00)	($80.00)	($80.00)	($80.00)	($80.00)
Total Payment, (2)	($60.00)	($100.00)	($120.00)	($380.00)	($60.00)	($80.00)	($80.00)	($340.00)
Prepayment on New VPF, (3)	$54.45	$90.75	$127.05	$363.00	$46.60	$77.67	$108.73	$310.67
Net Cash Flow, (4) = (2) + (3)	**($5.55)**	**($9.25)**	**$7.05**	**($17.00)**	**($13.40)**	**($2.33)**	**$28.73**	**($29.33)**
Tax Cost								
Realized Gain/(Loss), (1) + (2)	$30.75	($9.25)	($29.25)	($289.25)	$17.67	($2.33)	($2.33)	($262.33)
Disallowed Loss	$0.00	($9.25)	($29.25)	($289.25)	$0.00	($2.33)	($2.33)	($262.33)
Tax Cost @ 47.8% Tax Rate, (5)	($14.70)	$0.00	$0.00	$0.00	($8.44)	$0.00	$0.00	$0.00
Net-of-Tax Cash Flow, (4) + (5)	**($20.25)**	**($9.25)**	**$7.05**	**($17.00)**	**($21.84)**	**($2.33)**	**$28.73**	**($29.33)**

NOTES: The 47.8% tax rate includes a 37% top bracket federal tax rate, a 3.8% net investment income tax, and a hypothetical 7% state tax. The stock's value at the VPF's inception is $100. The rows with bold font indicate the main parameters of interest.

We observe that, depending on the stock value, the net cash flow may be positive or negative.

Exhibit 12, Panel A, further shows that cash settlement can result in a tax liability. When the settlement amount is smaller than the original prepayment amount, the investor realizes a gain, and vice versa: when the settlement amount is greater than the original prepayment amount, the investor realizes a loss. When a gain is realized, it is recognized as a short-term gain because, due to straddle rules, the VPF does not accrue a holding period. On the other hand, when a loss is realized, due to straddle rules, the loss is disallowed until the investor disposes of the offsetting stock position. This results in a $12.55 current tax liability when the stock's value is $60, and no current tax benefit from the loss incurred upon the termination of the original contract in the other three stock value scenarios shown in Panel A. The disallowed loss is added to the cost basis of the stock and reduces the realized gain when the stock is eventually sold. For example, when the stock's value is $400, after the roll, the stock basis increases from $0 to $289.25.

The net-of-tax cash flow upon cash settlement shown in Exhibit 12 is the pre-tax cash flow reduced by the tax cost. In Panel A, in the scenario where the stock's value is $60, the investor faces a substantial cash outlay for two reasons: First, the prepayment on the new VPF is lower than the cash settlement amount on the original VPF. Second, there is a significant short-term gain upon settling the original VPF in cash. Similar to the $60 scenario, when the stock's value is $100 or $400 at the time of the roll, there is a cash outlay due to the prepayment amount on the new VPF being lower than the cash settlement amount on the original VPF. However, unlike in the $60 scenario, in these two scenarios, there is no tax liability because the investor has a realized capital loss on the VPF. As a reminder, this loss is disallowed due to straddle rules. Only in the scenario where the stock's value is $140 does the prepayment on the new VPF exceed the cash settlement amount, resulting in a positive cash flow for the investor. As shown in Exhibit 12, Panel A, this positive net-of-tax cash flow is $7.05.[8]

Exhibit 12, Panel B, presents the same calculations for the wide-bound VPF. In this case, similar to the results in Panel A, the $140 stock value is the only scenario that generates a positive pre-tax and net-of-tax cash flow when rolling the VPF.

In Exhibit 13, we generalize the example shown in Exhibit 12 by varying the stock's value at VPF maturity continuously between $0 and $400. For this value range, we show the net cash flow, the tax cost, and the net-of-tax cash flow, all computed using the logic outlined in Exhibit 12.

For the narrow-band VPF described in Panel A, the net-of-tax cash flow is positive when the stock's value at the time of the roll ranges between $110.19 and $216.19, reaching the maximum amount of about $10 when the stock's value is at the original VPF's cap of $120.

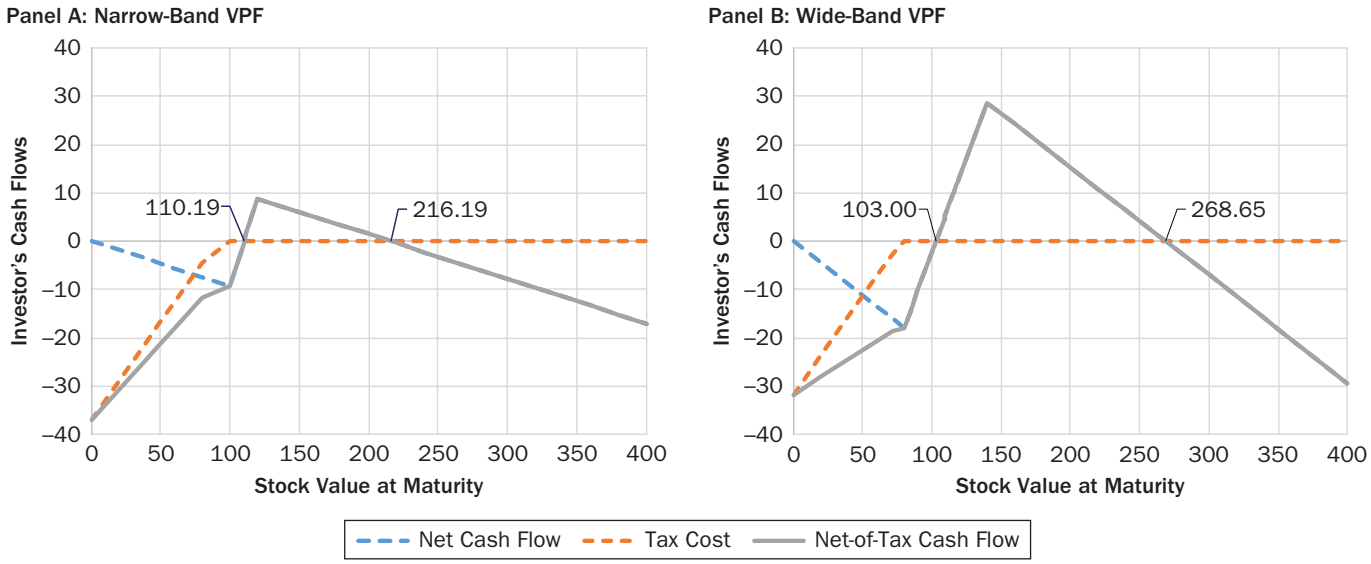
For the wide-band VPF described in Panel B, the net-of-tax cash flow is positive when the stock's value is between $103.00 and $268.65, reaching a maximum of approximately $30 when the stock's value is at the original VPF's cap of $140.

The illustration of cash flows associated with VPF rolls in Exhibit 13 suggests that if the stock price increases gradually and does not jump by, say, two times or more, the investor can pursue a strategy of rolling the VPF—either at or prior

[8] In our view, the net-of-tax cash flow upon VPF roll should not be directly compared to the tax cost of physical settlement. Physical settlement extinguishes the original VPF transaction. In contrast, the roll creates a new VPF transaction with its own expected tax cost at a future date. For an economically meaningful comparison, the tax cost of physically settling the original VPF should be weighed against the sum of the current cash flow upon the roll and the future tax cost of settling the new contract. This comparison is outside of the scope of this article.

EXHIBIT 13

Cash Flows upon a VPF Roll



NOTES: All values are in USD. The stock's value at the VPF's inception is $100.

to maturity—while at the same time obtaining positive cash flows from the rolls.[9] A particular problem with rolling a VPF arises when the stock price declines, even by a modest amount. In this case, the roll results in a negative pre-tax cash flow (because the cash settlement payment on the original VPF exceeds the prepayment on the new VPF) and a potentially significant tax liability. In other words, the strategy of rolling the VPF might fail to protect the investor against the very risk he or she sought to address by entering into the VPF contract in the first place.

CONCLUSION

This article makes three contributions to the literature. First, it develops a VPF pricing formula that is simple to understand and implement. This formula can be used by investors and their advisors to model VPF solutions and to sanity-check the quotes they receive from VPF providers. Second, the article provides a detailed discussion of the application of tax straddle rules to VPF transactions. Third, it explains how to calculate cash flows and tax liabilities arising from VPF rolls.

The main conclusions are as follows. First, a properly structured VPF can offer a substantial prepayment amount; in some circumstances, the prepayment can significantly exceed 90% of the value of the stock. Second, while the VPF prepayment amount is affected by market conditions, underlying stock characteristics, and the VPF provider financing spread, the structure of the VPF—particularly its floor—has a first-order effect on the VPF prepayment amount. Finally, there is a range of stock prices around the price at the VPF's inception where rolling a VPF can generate a positive cash flow for the investor. However, rolling a VPF can be very costly, both from a pre-tax and tax perspective, if the stock price falls outside this sweet-spot range. Rolling a VPF can be especially costly when the stock price declines significantly, which is the very scenario from which the investor seeks protection by entering into the VPF contract in the first place.

[9] Note that in this case, the tax liability upon physical settlement is not eliminated but rather deferred.

APPENDIX

THE LEGAL AUTHORITY FOR VPF CONTRACTS

The legal authority for VPF contracts is derived from IRS Revenue Ruling 2003-7, in which the IRS analyzed a specific VPF contract and concluded that this contract does not constitute either a sale or a constructive sale. According to the ruling's conclusion:

"Shareholder has neither sold stock currently nor caused a constructive sale of stock if Shareholder receives a fixed amount of cash, simultaneously enters into an agreement to deliver on a future date a number of shares of common stock that varies significantly depending on the value of the shares on the delivery date, pledges the maximum number of shares for which delivery could be required under the agreement, retains an unrestricted legal right to substitute cash or other shares for the pledged shares, and is not economically compelled to deliver the pledged shares."

There are several key components of a VPF highlighted in this conclusion. First, the number of shares to be delivered at maturity "varies significantly depending on the value of the shares" on that date. The specific contract analyzed in the ruling had a floor equal to 100% and a cap equal to 120% of the value of the stock at the contract's inception.[10] As a result, a 20% gap between the cap and the floor generally has been considered sufficient for the number of shares to be delivered at maturity to vary significantly with the value of the shares. This variation in the number of shares upon physical settlement of the contract is illustrated in Exhibit 2.

Second, the investor "pledges the maximum number of shares for which delivery could be required." When the stock value is at or below the VPF floor, the investor indeed delivers all the pledged shares to the bank. It is evident from Exhibit 2 that only when the stock value exceeds the floor does the investor retain some fraction of the pledged shares.

Third, the investor "retains an unrestricted legal right to substitute cash or other shares for the pledged shares and is not economically compelled to deliver the pledged shares." Exhibit 3 shows the cash amount that the investor is required to deliver in lieu of the pledged shares (and thereby reacquire all the pledged shares). One of the terms of a properly structured VPF is that the investor preserves the right to choose among physical settlement, cash settlement, or settlement with another stock, with no compulsion in the terms of the contract to use one form of settlement over another.

Finally, although it is explicitly mentioned in the conclusion, the text of the ruling makes it clear that the investor must retain "the right to receive dividends and exercise voting rights with respect to the pledged shares." These rights ensure that the investor maintains ownership of the stock during the life of the contract rather than selling it at the contract's inception.[11]

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[10] The specific VPF contract analyzed in Revenue Ruling 2003-7 also included limited participation beyond the cap. However, since then, most VPFs have been offered without participation beyond the VPF cap.

[11] Retaining ownership of the pledged stock is critical for deferring gain recognition until the VPF matures. In the famous Anschutz Co. v. Commissioner Tax Court case, the pledged stock was lent to the bank, granting the bank the right to sell the stock. Due to the bank's rehypothecation rights with respect to the pledged stock, the IRS treated the transaction as a sale at the contract's inception, rather than at maturity—a decision with which the Tax Court concurred (135 T.C. No. 5, Dec. 58,275 (2010)). The Tenth Circuit upheld the Tax Court's ruling, determining that the stock loan transferred both legal title and the power to dispose of the stock to the bank (664 F.3d 313 (10th Cir., 2011)).

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