1. A forward contract is an agreement to buy or sell an asset at a certain future time for a certain price (called the forward price). At the time a forward contract is entered into, no money changes hands. The investor who agrees to buy the asset at the future time is said to hold the long position in the contract and the investor who agrees to sell the asset is said to hold the short position in the contract. Suppose that a stock is currently selling for $30 per share. A (long position in a) forward contract is available to buy 100 shares of the stock 3 months from now for $30.25 per share. Suppose that a bank is offering interest at the rate of 5% per annum (compounded continuously) on a 3-month deposit. Describe a strategy for creating an arbitrage profit and compute the amount of the profit.

Solution. At time 0, borrow 100 shares of the stock, sell them immediately for $3000, and put this money in the bank. After 3 months the bank account has grown to $3000 \cdot \exp(0.05 \cdot (3/12)) \approx 3,037.74. At that point use the forward contract to buy 100 shares for $3025 to replace the borrowed shares. The remaining $12.74 is a risk-free profit.

2. On February 4, 2020, a European call option on Apple (AAPL) has a price of $30. The option expires on February 21 (the third Friday of February), and the strike price is $300. The price of Apple stock on February 5 is $320 per share.

Analyze this situation in the manner of the Example on page 3 of the text, considering two possible scenarios: (1) The price of Apple on February 21 is $360; (2) The price of Apple on February 21 is $280. In each case compute the profit (or loss) incurred as a percentage of the investment if one were to invest $3000 in (a) the call option on 100 shares of Apple, or (b) Apple stock.

Solution. If one bought such an option on 100 shares of Apple stock, the cost on February 4 would be $3000 and on February 21 one would have the right to buy 100 AAPL shares for $300 per share. We assume for simplicity that $1 on February 4 is worth $1 on February 21.

Under scenario (1), the holder of the option will exercise the option (and upon buying 100 shares for $300 apiece, turn around and sell them at the market price of $360), making a net profit of $360 – $300 – $30 = $30 per share, for a total net profit of $3000 on an investment of $3000. This is a 100% profit. If, on the other hand, the $3000 had been invested in AAPL on February 4, the investor could have bought 9 whole shares (with $2880), which on February 21 would be worth $3240, for a net profit of $3240 – $2880 = $360 on an investment of $2880, which is a \( \frac{360}{2880} \times 100\% = 12.5\% \) profit.

Under scenario (2), the holder would not exercise the option, and so would take a total net loss of $3000—this is a 100% loss of the investment in the option. If, on the other hand, the $3000 had been invested in (9 shares of ) the stock, the loss incurred would have been \((320 – 280) \cdot 9 = 360\), which is a \( \frac{360}{2880} \times 100\% = 12.5\% \) loss on an investment of $2880 in stock.