Chapter 1: A Brief Introduction to Derivatives and Financial Markets

A. Derivative Securities: A Brief Introduction

A *derivative security* is simply a financial instrument whose value is derived from that of another security, index, rate or event. Many different types of derivative securities are very important for the management and mitigation of a variety of different types of risks to business, financial and other institutions and investors, enabling such entities to better allocate capital and plan for their futures. Later, we will demonstrate how the pricing of derivative securities can provide useful information regarding other securities and instruments. Derivative securities certainly play productive roles in modern economies well-beyond providing speculative and gambling opportunities and enabling speculators to transfer wealth among themselves. Derivative securities and play an essential role in the maintenance of active and efficient capital markets, which are in turn essential to the output and growth of world economies.

Derivative securities in general are not an exotic invention of modern Wall Street security dealers; derivatives have played important roles in world economies for centuries. In fact, trading in futures contracts predates by centuries trading in stock markets; there is evidence of trading in rice futures in China dating back to 6000 B.C.E. Other early examples of derivative markets include agricultural futures contracts dating back to *c*.2000 B.C.E. in India and option contracts on ship cargos created by ancient Phoenicians and Greeks. For example, the Greek mathematician and philosopher Thales of Miletus negotiated for himself an early *call* contract granting him the right to buy or use olive presses at harvest time. Athenians used shipping contracts stipulating commodities, quantities, pricing and delivery dates in a manner that resembled forward contracts. Sixteenth century bourses in Antwerp and later Amsterdam and the Dojima Exchange in Osaka regularly traded commodity forward and early versions of futures contracts. As is the case with modern futures exchanges, the Dojima Exchange contracts were executed through a clearinghouse, an institution that serves as an intermediary between contract participants and guarantees delivery and payments. Futures markets started to become more organized with standardized contracts and regulations in the 19th century as exchanges developed specifically to trade derivative contracts. For example, the Chicago Board of Trade first offered forward contracts in 1851 and commodity futures in 1865. Such instruments have helped manufacturers, farmers, mining companies, traders and transporters manage a multiplicity of risks ranging from stock market volatility to borrower default.

As we mentioned above, markets for derivatives are crucial to business for the management of many types of risks. Risk factors frequently hedged with derivatives include but are not limited to uncertainties associated with interest and exchange rates, client default, economy-wide and industry specific output. Markets for explicit insurance policies on such a wide array of risks do not exist largely due to contracting costs. Most insurance policies are fairly standardized (e.g., health, life and many casualty policies), while customized insurance contracts are expensive and time consuming to write. Businesses must be able to act quickly to manage their risks in this environment of rapid change. Flexibility and liquidity along with low contracting and transactions costs are key to the success of the risk management operations of a firm. An active and efficient market for derivative securities can meet these important flexibility and liquidity requirements.

Business firms and individual investors desiring to hedge risks are not the only participants in markets for derivatives. A second type of market participant is the speculator who takes a position in a security based on his expectation regarding future price movement.

Although the speculator is essentially concerned with his own trading profits, he plays an important role in maintaining liquidity in derivative markets, affording business and individual investors the opportunity to hedge risks quickly and efficiently. The speculator is often the counterparty to a hedger's trade, selling or purchasing derivatives as required by hedgers.

The arbitrageur, who exploits situations where derivatives are mispriced relative to one another and to other securities not only provides additional liquidity to derivative markets but plays an important role in their pricing. By constantly seeking price misalignments for a variety of types of securities, and by understanding the payoffs of securities relative to one another, arbitrageurs help ensure that derivative securities are fairly priced. This activity reduces price volatility and uncertainty faced by hedgers. The *arbitrageur* seeks to profit from violation of the *Law of One-Price*, which holds that securities and portfolios that offer the same future cash flows must sell at the same price.

B. Financial Securities, Instruments and Markets: A Brief Review

Here, we provide a review of elementary definitions and concepts related to financial instruments and markets. We will focus more specifically on derivative instruments and the markets in which they trade shortly.

Securities and Instruments

A security is a tradable claim on assets. Real assets contribute to the productive capacity of the economy securities are financial assets that represent claims on real assets or other securities. Most securities are marketable to the general public, meaning that they can be sold or assigned to other investors in the open marketplace. Some of the more common types of securities and tradable instruments are briefly introduced in the following:[1]

1. *Debt securities*: Denote creditorship of an individual, firm or other institution. They typically involve payments of a fixed series of interest (often known as *coupon payments*) or amounts towards principal along with principal repayment (often known as *face value*). Examples include:
   - *Bonds:* Long term debt securities issued by corporations, governments or other institutions. Bonds are normally of the coupon variety (they make periodic interest payments on the principal) or *pure discount* (they are *zero coupon instruments* that are sold at a discount from *face value*, the bond's final maturity value).
   - *Treasury securities:* Debt securities issued by the Treasury of the United States federal government. They are often considered to be practically free of default risk.
2. *Equity securities (stock):* Denote ownership in a business or corporation. They typically permit for dividend payments if the firm's debt obligations have been satisfied.
   - *Common stock*: Security held by the residual claimant or owner of the firm
   - *Preferred stock*: Stock that is given priority over common stock in the payment of dividends and liquidation; preferred stockholders must receive their dividends if common stockholders are to be paid dividends
3. *Derivative securities:* Have payoff functions derived from the values of other securities, rates or indices. Some of the more common derivative securities are:
   - *Forward* and *Futures Contracts:* Instruments that oblige their participants to either

[1] Many descriptions of securities, markets, regulations and institutions here, and elsewhere in this manuscript are adapted from Teall [2023].

purchase or sell a given asset or security at a specified price (settlement price) on the future settlement date of that contract. A *long* position obligates the investor to purchase the given asset on the settlement date of the contract and a *short* position obligates the investor to sell the given asset on the settlement date of the contract.

- *Options:* Securities that grant their owners rights to buy (*call*) or sell (*put*) an underlying asset or security at a specific price (exercise price) on or before its expiration date.
- *Swaps*: Provide for the exchange of cash flows associated with one asset, rate or index for the cash flows associated with another asset, rate or index.
- *Exotics*, or *exotic options* are options contracts with plain vanilla options." There are also many exotic options with more complex contractual terms than the "plain vanilla options" just discussed. Such complexities might include exercise prices based on the minimum or average historical price over a given time frame.
- *Other*: There are a wide variety of other types of derivative instruments, including *collateralized debt obligations* (CDOs), *American Depository Receipts* (ADRs), and *weather derivatives*.

4. *Commodities*: Contracts, including futures and options on physical commodities such as oil, metals, corn, etc. Commodities are traded in *spot markets*, where the exchange of assets and money occur at the time of the transaction or in forward and futures markets.
5. *Currencies*: Exchange rates denote the number of units of one currency that must be given up for one unit of a second currency. Exchange transactions can occur in either spot or forward markets. As with commodities, in the spot market, the exchange of one currency for another occurs when the agreement is made. In a forward market transaction, the actual exchange of one currency for another actually occurs at a date later than that of the agreement. Spot and forward contract participants take one position in each of two currencies:
   - *Long*: An investor has a "long" position in that currency that he will accept at the later date.
   - *Short*: An investor has a "short" position in that currency that he must deliver in the transaction.
6. *Funds*: Funds are portfolios of securities, with ownership divided among investors through shares. Mutual funds exist to enable investors to hold shares of portfolios and exchange-traded funds can be traded in exchange markets. Investors can purchase shares of funds, and various types of derivative contracts will trade on certain funds.
7. *Indices*: Contracts pegged to measures of market performance such as the Dow Jones Industrials Average or the S&P 500 Index. Many such instruments are futures contracts on portfolios or funds structured to perform exactly as the indices for which they are named. Index traders also trade options on these futures contracts.
8. *Hybrids*: combining features of two or more securities (e.g., a convertible bond, which can be converted into stock at the option of the bondholder).

It is important to note that this list of security types is far from complete; it only reflects some of the instruments most frequently discussed in this book. In addition, most of the instrument types will have many different variations.

Investors trade securities for investment purposes. Their purchases might be motivated by profit motives or by risk management. Profits might be obtained through successful *speculating* (correctly forecasting the direction of security prices and payments associated with securities). Speculators are highly dependent on quality information. A second potential source of profits is

arbitrage, the simultaneous purchase and sale of the same or substantially similar asset at different prices. Arbitrage succeeds when the prices of purchased assets is less than the prices of sold assets. Arbitrageurs are highly dependent on low transaction costs and speed of trade execution. Profits can also be obtained through *market making*, that is, by providing liquidity while profiting from differences between bid and offer prices (known as *spreads*). Dealers maintain *quotes* (*bids*, which are solicitations to purchase and *offers*, which are solicitations to sell) and buy and sell on a profit basis. Many investors will profit from all three types of trading motivations. Investors might also purchase securities to manage risk. For example, some securities serve as excellent hedges for others. Securities are purchased from and sold to *counter parti*es and the acquisition and liquidation processes are referred to as *trading*.

Financial Markets

Traders compete to generate profits. *Proprietary traders* seek profits by trading on their own accounts while *agency traders* trade as commission brokers on behalf of clients. Most proprietary traders in derivative markets are speculators who focus on profits derived from price changes, arbitrageurs who focus on price discrepancies, and hedgers who seek to control risk. *Dealers*, who trade directly with clients, and *brokers*, who seek trade counterparties for clients, facilitate the trading process. Brokers act as agents for investors, buying and selling for them on a commission or mark-up basis.

Trading occurs in securities markets, physical or virtual, where traders communicate with one another and execute transactions. The basic function of a market is to bring together buyers and sellers. Most markets also provide information in the price discovery process, and the information revealed in this process is a function of market structure.

The United States Securities and Exchange Act of 1934 defined an exchange to be:

> any organization, association, or group of persons, whether incorporated or unincorporated, which constitutes, maintains, or provides a marketplace or facilities for bringing together purchasers and sellers of securities or for otherwise performing with respect to securities the functions commonly performed by a stock exchange as that term is generally understood, and includes the marketplace and the market facilities maintained by such exchange.

Securities regulatory agencies such as the Securities and Exchange Commission (SEC) in the U.S. consider an *exchange* to a physical or virtual meeting place drawing together brokers, dealers, and traders to facilitate the buying and selling of securities, which, most importantly, is duly registered with the agency or commission as an exchange. Thus, exchanges include the floor-based markets where brokers and traders physically congregate as well as many virtual meeting sites and screen-based systems provided by electronic *communications networks* (ECNs). In the United States and many other countries, exchange transactions are executed through some type of auction process.

Exchanges in the United States are intended to provide for orderly, liquid, and continuous markets for the securities they trade. A *continuous market* provides for transactions that can be executed at any time for a price that might be expected to differ little from the prior transaction price for the same security.

Traditionally, transactions that occur outside of exchange markets are referred to as *over the counter transactions*. Thus, over the counter markets (OTC) have traditionally been defined as non-exchange markets. Where the expression applies, OTC markets are made up of broker-dealer houses that execute transactions on behalf of client accounts as well as their own. In

addition, included are transactions executed directly by trading counterparties. Almost all federal, municipal, and corporate bonds are traded in the OTC markets as well as many derivative products, structured products, and shares of smaller corporations.

Derivative securities are traded in the United States either on exchanges or in Comarkets. Substantial market interest is required for exchange listing, whereas securities with smaller followings or even customized contracts can be traded over the counter. The role of the derivatives dealer is essentially the same as that for other security dealers: to facilitate transactions for clients at competitive prices. *Dealers* match counterparties for derivative contracts, act as a counterparty for many of their own custom contracts and provide an array of support services including expert advice and carefully engineered customized risk management products. It is necessary that the dealer providing full support services have a proper understanding of his client, his business and the client's needs. Since most clients do not understand the technical terms used in the industry, the dealer must be an effective communicator. It is equally important for the dealer to understand the nature of the securities with which he deals and how serving as a market maker for derivatives affects the risk structure of his employer. This understanding usually requires strong analytical skills.

Market Efficiency

The concepts of market efficiency and arbitrage are essential to the development of most financial models and help with our understanding of pricing. *Market efficiency* is the condition in which security prices fully reflect all available information. This implies that all transactions have zero net present value (zero NPV, where NPV equals Present value of future cash flows minus initial cash investment). Such efficiency is more likely to exist when wealth-maximizing participants in competitive markets can instantaneously and costlessly execute transactions as information is revealed. Transactions costs, irrationality and poor execution systems reduce efficiency. The extent to which markets are actually efficient is open to debate, but assuming market efficiency is often prudent for strategy development until strong evidence presents to the contrary.

Arbitrage

Arbitrage, in its simplest scenario, is the simultaneous purchase and sale of the same asset, or more generally, the nearly simultaneous purchase and sale of assets generating nearly identical cash flow structures. In either case, the arbitrageur seeks to produce a profit by purchasing at a price that is less than the selling price. Proceeds of the sales are used to finance purchases such that the portfolio of transactions is *self-financing*, and that over time, no additional capital is devoted to or lost from the portfolio. Thus, the portfolio is assured a non-negative profit at each time period. The arbitrage process is riskless if purchase and sale prices are known at the times they are initiated. Arbitrageurs frequently seek to profit from market inefficiencies. The existence of arbitrage profits is inconsistent with market efficiency.

Trading, Futures and Weather Forecasting

Whereas hedgers, speculators and arbitragers all play an important role in the pricing of and liquidity maintenance for derivatives, derivatives actually play a role in the evaluation of risks and prices for other securities. In some instances, derivatives prices can even be used to forecast events. For example, it is well known that futures prices provide valuable information for predicting commodity prices and interest and exchange rates. This information is most useful

for business planning. In fact, one very interesting study by Roll and French [1986] showed that market prices of orange juice futures anticipated severe winter weather conditions more accurately than did the National Weather Bureau forecasts. In addition, sophisticated stock analysts realize that the price of a stock option is most sensitive to the risk of the underlying stock. Thus, analysts frequently rely on the option price to provide information on the risk of the underlying stock. As we will discuss later, market prices of derivative securities in general are quite useful for assessing the magnitude and pricing of a multitude of different risks.

C. Introduction To Commodities, Forward and Futures Markets

Commodities are physical products used for consumption or production. Forward and futures contracts are essential in markets for a wide variety of types of commodities. Forward and futures are similarly important in markets for a variety of financial instruments, including currencies, equity indices, debt instruments, etc.

Commodities

A commodity market trades in raw or primary products rather than manufactured products. *Soft commodities* are agricultural products such as wheat, livestock, coffee, cocoa and sugar. *Hard commodities* are mined or extracted, such as gold, rubber, natural gas and oil. More recently developed commodities markets include those for emissions, electricity and cell phone minutes. Well-developed commodity markets require that the commodities be well-defined and standardized. For example, one ounce of gold of a given purity should be the same regardless of who owns or sells it. Commodity markets can include physical trading of the actual commodity or a variety of derivative contracts including spot contracts, forwards, futures, options on futures and swap contracts.

Forward and Futures Contracts

Whereas a *spot contracts* provides for delivery of a commodity or instrument and for its payment at the time the contract is agreed, forward and futures contracts provide for delivery and payment at some later *settlement date*. However, as we will discuss below, there are some key differences between forward and futures contracts.

Forward Contracts and Markets

A *forward contract* represents an agreement providing for delivery of a given quantity of an asset at a later date at a given price. Essentially, a forward contract provides for the seller (an entity taking the short position on the asset) to deliver the specified asset on a settlement date (or month) to a purchaser (an entity taking the long position on the asset). The actual exchange of the asset for cash occurs at settlement, a date after the date of origination of the forward contract. Many forward transactions involve direct negotiations between banks, brokerage firms and other financial institutions. Because forward contracts are often individually negotiated and non-standardized, they normally do not have well-developed secondary markets and tend to be illiquid.

Futures Contracts and Markets

A *futures contract* also represents an agreement specifying delivery of given quantity of an asset on a settlement date at a given price. However, the futures contract differs from a forward contract in several important ways. First, a forward contract is created by its long and

short participants according to whatever terms they agree. Most forward contract participants are institutions such as banks. On the other hand, a futures contract is created by a *clearinghouse* which acts as a middleman between all contract participants and may or may not be affiliated with an exchange. The clearing house serves as counterparty on all transactions which effectively eliminates default risk. Thus, the clearinghouse is a party to every futures contract. A futures contract is traded on an exchange, normally an exchange affiliated or contracting with the clearinghouse. To facilitate trading and to ensure that a reasonably large number of investors will be interested in the futures contract, the futures contract is standardized with respect to the exact quantity and nature of the asset to be delivered along with the settlement date. To ensure that both parties to the futures contract will honor their commitments, futures traders are required to post *margin* with their brokers, which is, in effect, collateral or performance bond required by the brokerage firm. Furthermore, futures contracts often provide for *marking to the market*, which involves daily re-computations of the margin requirement based on updated asset value. Finally, while forward contracts frequently settle with delivery of the underlying asset, futures contracts typically provide for settlement by cash equivalence.

Exchanges and clearing houses will clearly specify terms of futures contracts. First, the asset, its quality and grade are specified in the contract, along with the size of the contract (e.g., weight, volume, etc.) and the asset delivery terms. Although physical delivery of the asset is rare because most contracts are *closed out* (canceled by offsetting trades) prior to maturity or provide for the delivery of cash equivalence (*cash settlement*), these terms are still important. A contract will also provide for a settlement date or delivery month.

There are several important exchanges that trade futures contracts, including the Chicago Board of Trade, the Chicago Mercantile Exchange and the New York Mercantile Exchange. Table 1.1 provides a listing of major U.S. futures exchanges. In addition to these markets, the London Metal Exchange, the Tokyo Commodity Exchange and OTC markets are among the world markets that are very active. Futures markets in the U.S. are regulated and overseen by the Commodities Futures Trading Commission (CFTC), the National Futures Association (NFA) and to a much lesser extent, the Securities Exchange Commission (SEC).

Futures contracts have been traded for many centuries on many types of commodities, including agricultural products such as corn, wheat and pork bellies, metals such as gold and copper, minerals such as diamonds, petroleum and phosphates, as well as paper and timber. Futures contracts are traded on an assortment of financial securities such as treasury bonds, equity market indices and interest rates. As discussed in previous sections, futures contracts also trade on many different currencies.

U.S. Futures Exchanges
Chicago Board of Trade
CBOE Futures Exchange, LLC
Chicago Mercantile Exchange
One Chicago, LLC
The Island Futures Exchange, LLC
NQLX LLC

TABLE 1.1: U.S. Futures Exchanges as of April 2017

Futures Contracts and Business Risk

Although futures markets allow investors to speculate and engage in arbitrage, one of their most important functions is to enable businesses to control risk. Businesses with foreign customers and suppliers frequently use futures contracts to hedge their exchange rate risk. For example, consider a Japanese firm ordering a communications system from an American manufacturer for $5,000,000 payable upon delivery in six months. The Japanese firm is obliged to pay in dollars but has no control over the price of dollars in yen; thus, it faces the risk that the value of the dollar will increase from its current price of, say, ¥100 per dollar.

Since most U.S. firms expect to be paid for their products with dollars, many foreign firms and individuals with this type of exchange rate risk would be discouraged from purchasing American products. However, there are several types of derivative securities to control this risk. For example, the Japanese firm could purchase in American markets put options (options to sell) on ¥500,000,000 with an exercise price of $0.01 per yen. This purchase of puts would guarantee the Japanese firm a minimum selling price for ¥500,000,000needed to purchase $5,000,000. If the price of dollars were to decline, the Japanese would simply purchase the $5,000,000 in cash markets for fewer yen.

D. Introduction to Options Contracts and Markets

An *option* is a contract that grants its owner the right (though, not obligation) to either buy or sell a given asset. There are two types of "plain vanilla" options: puts and calls. A call grants its owner to purchase an underlying asset for a specified exercise price (also known as a *striking price*) on or before the expiration date of the contract. A *put* grants its owner the right to sell the underlying asset at a specified exercise price on or before its expiration date. The owner of the option contract may exercise her right to buy or sell; however, she is not obligated to do so.

Stock options are simply contracts between two investors issued with the aid of a clearing corporation that ensures that investors honor their obligations to each other and actually issues the contracts. The corporation on whose stock options are traded will probably not issue and does not necessarily trade these options (except for warrants on treasury stock). Investors create and trade option contracts amongst themselves.

For each owner of an option contract, there is a seller or *writer* who either creates or sells the contract to a buyer and must satisfy an obligation to the owner of the option contract when it expires. The *option writer* sells (in the case of a call exercise) or buys (in the case of a put exercise) the stock at the exercise price when the option owner exercises. The owner of a call is likely to profit if the asset underlying the option increases in value over the exercise price of the option (he can buy the asset for less than its market value); the owner of a put is likely to profit if the underlying asset declines in value below the exercise price (he can sell asset for more than its market value). Since the option owner's right to exercise represents an obligation to the option writer, the option owner's profits are equal to the option writer's losses. Therefore, an option must be purchased from the option writer; the option writer receives a *premium* (the price paid for the option) from the option purchaser for assuming the risk of loss associated with enabling the option owner to exercise.

European and American Options

Options may also be classified into either the European variety or the American variety. *European options* may be exercised only at the time of their expiration; *American options* may

be exercised any time before and including the date of expiration. We will demonstrate later that American options can never be worth less than their otherwise identical European counterparts.

Although American options can be exercised early, in practice, most are not. When the underlying security pays no dividends or experiences no leakage, American calls are always worth more "alive than dead." American puts are exercised early only when the present value of receiving exercise money earlier rather than at expiration exceeds the value of the unexercised put. These practical issues greatly simplifies the process of options valuation.

Options Markets

Prior to 1973, options traded in OTC markets, with trades communicated by telephone to brokers, with more liquid contracts having quotes listed in major financial newspapers. Now, most stock options are traded on one of the options exchanges, all of which take trades electronically. Table 1.2 below lists the most important U.S. options exchanges as of calendar year 2020. We will continue this discussion in Chapter 6.

Exchange	Cleared Contracts	Total Premiums	Avg. Daily Contracts	% Market Share
AMEX	40,052,656	$7,194,355,365	494,477	6.23%
ARCA	46,398,747	$9,835,963,150	572,824	7.21%
BATS	80,526,945	$13,236,975,848	994,160	12.52%
BOX	19,523,025	$3,402,861,794	241,025	3.03%
C2	12,654,695	$2,228,564,252	156,231	1.97%
CBOE	114,005,724	$22,220,467,876	1,407,478	17.72%
EDGX	8,272,243	$1,252,798,162	102,126	1.29%
GEM	39,509,887	$6,994,957,378	487,776	6.14%
ISE	56,012,033	$15,048,479,569	691,507	8.71%
MCRY	1,226,017	$263,865,500	15,136	0.19%
MIAX	41,402,081	$5,584,565,629	511,137	6.44%
MPRL	886,941	$171,216,079	10,950	0.14%
NOBO	5,103,126	$681,069,918	63,002	0.79%
NSDQ	71,436,631	$12,703,227,700	881,934	11.10%
PHLX	106,360,933	$27,025,495,817	1,313,098	16.53%
TOTAL	643,371,684	$127,844,864,169	7,942,860	100.00%

TABLE 1.2: U.S. Equity Options Exchanges (Data from OCC, 2021)

E. Introduction to Swaps and Other Derivative Instruments

There are a wide variety of other types of derivative contracts traded on a wide variety of financial instruments. Only two will be introduced here; more details on these and on other derivative instruments will be provided in Chapter 12.

Swap Contracts

Swap contracts provide for the exchange of cash flows associated with one asset, rate, or index for the cash flows associated with another asset, rate, or index. Swap contracts are useful for managing a variety of types of risk, particularly interest rate, credit and exchange risk. There are a wide variety of types of swap contracts. For example, an interest rate swap might provide

for the exchange of future cash flows from a fixed-rate bond for the cash flows associated with a variable interest-rate debt instrument. Many swap contracts trade on designated *swap execution facilities (SEFs)*, which are registered electronic trading systems that enable swap traders to provide and obtain quotes and execute swap transactions by accepting bids and offers. An SEF is in many respects similar to a formal exchange, though the term refers to any distributed group of approved trading systems for swaps but is not regulated as an exchange.

Collateralized Debt Obligations

A *collateralized debt obligation* (CDO) is a marketable instrument by which specified events determine the payouts associated with multiple classes of holders of debt-backed assets. Whereas pass-through securities described above represent fractional claims on interest and principal payments associated with a pool of mortgages, the CDO restructures the pool payouts differently.

F. The Dark Side of Derivatives

When unfair or dysfunctional markets fail to draw traders, they cannot draw capital. The mere perception of dysfunction or unfairness is disruptive and can break down markets (Guiso, Sapienza, & Zingales, 2008). In Section 1.8, we discussed the importance and scale of financial trading to national and global economies. Trading does matter, and when trading goes awry, the ill effects can be far-reaching and devastating. In this chapter, we review a number of types of failures in trading along with their adverse effects on a variety of stakeholders, including traders, their employers, the financial services industry, and to society itself.[2]

Costs of Trading Fraud

Securities fraud is expensive to securities firms, very difficult to detect, and more difficult still to evaluate, especially on an economy-wide basis. Consider the $139 billion in fines paid by the finance industry (these fines were not all connected to securities fraud) to U.S. enforcement agencies during the two-year period 2012-2014 and the many more fines that would have been assessed if not for failures of the affected firms or success in avoiding detection (Zingales, 2015). Dyck, Morse and Zingales (2014) note that the "main challenge in assessing the cost of fraud is that we only observe detected fraud: we do not know whether the observed fraud is the whole iceberg or just its visible tip." Based on a study of firms switching auditors after the demise of Arthur Anderson, the major accounting firm that failed in the wake of the Enron scandal, Dyck, et al. were able to estimate that only about a quarter of frauds are detected. Essentially, this study determined that Arthur Anderson detected only about a quarter of the financial frauds committed by their clients. The successor auditors to Arthur Anderson, who presumably had fewer disincentives to catch frauds, unveiled about three times as many frauds actually committed by their auditing clients. They extrapolated this "detection failure" rate to the economy. While most of the frauds relevant to this study were not trading frauds, the study might be suggestive of detection rates for various types of financial fraud.

The costs of securities fraud affect everyone. First, the rather opaque indirect costs of securities fraud almost certainly exceed the direct costs. For example, securities fraud distorts investor capital allocation decisions. Gurun, Stoffman, and Yonker (2018) argue that investors significantly change their investment behavior as a result of a failure of trust in the financial services industry. In particular, they found that residents of communities with zip codes that were

[2] Much of the early part of this section draws from Teall (2023).

more exposed to the Madoff Ponzi fraud "withdrew assets from investment advisers and increased deposits at banks." The magnitude of this study's results (over $363 billion moved, 20 times the direct effect of the fraud itself) are large enough to imply that, overall, securities fraud has a significant impact on how investors allocate their capital. More generally, based on several extrapolations, Dyck et al. (2014) estimated the net annual costs of financial fraud at $380 billion, roughly a fifth of the market value of directly affected firms, and consistent with the proportional losses estimated by Karpoff, Lee, and Martin (2008). Dyck et al. further estimated that roughly one in seven firms engaged in fraud. Again, these frauds are not necessarily specific to trading, but trading fraud rates, extremely difficult to estimate, might be similar.

Failure and Losses in Derivative Markets

While derivatives do play an important role in our economy by enabling investors to hedge risk, speculate and price other assets, several well-publicized difficulties have arisen from their use (and misuse). First, many derivative contracts have been created to be highly leveraged, so that very large profits or losses may result from relatively small price shifts in the underlying asset. Small price changes in the wrong direction or seemingly minor imbalances in hedges can become devastating. This feature makes it crucial for financial managers to fully understand the features and implications of the contracts with which they deal. However, many of these contracts are somewhat complicated such that many of their users are not able to fully understand their implications. This has led to some very highly publicized losses and failures, including those at Procter & Gamble (over $100 million due to interest rate contracts), Gibson Greetings (over $20 million), Orange County ($1.7 billion in interest rate derivatives) and Metallgesellschaft ($1.4 billion in oil futures).

Tracking the values of derivative positions and reporting them on accounting statements are very difficult because many contracts do not conform to characteristics of assets typically reported by accountants. Even Financial Accounting Standards Board (FASB) opinions regarding "marking to the market" have not always been very helpful because many derivative contracts either have at best a very thin market and are subject to extreme pricing volatility. Accounting difficulties make it practically impossible for investors, regulators, managers and even auditors to understand the impact of derivatives investment on firms. These difficulties have led to several frauds that ultimately caused failures, including Barings Bank ($1.4 billion in Nikkei-index derivatives). It seems that financial innovators have been able to develop new derivative securities faster than accountants and regulators have been able to develop techniques for tracking their values and implications.

The 2008 Banking Crisis and the Aftermath

The 2008 U.S. banking crisis was the result of many factors, but among the major contributors to the crisis was the creation and active trading of new types of financial instruments, including mortgage-based derivatives such as CDOs and CDSs (credit derivative obligations and credit derivative swaps, to be defined later). These new instruments gave banks opportunities to take a variety of types of new positions in mortgage risk, created new financial complications and reporting complexities. The proliferation of these instruments made it more difficult for regulators and even the banks themselves to accurately gauge risk.

Wild derivatives trading and huge losses did not end with the financial crisis of 2008. For example, in 2012, it was widely reported that former highly compensated JPMorgan Chase trader Bruno Iksil, also known as the "London Whale," and his team of traders who lost approximately

$6 billion trading credit default swaps and other instruments, partly due to inadequate risk controls. It appears that bank supervisors may have been aware of the large and risky trade positions. The bank was criticized by regulators for its high-risk trading strategies, weak management, poor response to this crisis, and failing to co-operate with regulators. Ultimately, the bank agreed to pay approximately $920 million in fines to U.S. and U.K. regulators to settle charges related to this "London Whale" trading debacle, accepting responsibility for engaging in unsafe and unsound practices and failing to oversee its traders. In its investigation of this fiasco, the U.S. Senate's Permanent Subcommittee on Investigations found that Chase "disregarded multiple internal indicators of increasing risk; manipulated models; dodged oversight; and misinformed investors, regulators and the public about the nature of its risky derivatives trading."

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Exercises

1. In perfectly efficient markets where prices fully reflect all available information, security prices should be expected to evolve randomly. If price changes reflect new information, why should returns fluctuate randomly?

2. Suppose that a cereal manufacturer needs to purchase wheat in three months for cereal production and a farmer supplying the manufacturer, who is just now planting seed that he wishes to sell at harvest in three months. Since the market price of wheat is likely to be affected by general economic and trade conditions, weather, and many other factors beyond the control of the two trading partners, neither knows what the price of wheat will be in three months. Hence, the manufacturer faces uncertainty with respect to cereal production costs and the farmer cannot know what revenues he will derive from the sale of his produce. Such uncertainty clearly affects the abilities of the trading partners to make appropriate business decisions, and, if uncontrolled, might cause both to scale back their levels of operations to avoid devastating losses. How might the manufacturer and farmer use a futures contract to agree on a transaction price of wheat in advance?

3. How does a U.S.-based securities marketplace successfully obtain regulatory recognition as a securities exchange?

Solutions

1. New information or news arrives randomly; otherwise, it is not news. Thus, price reactions to news will be random.

2. Either an appropriate forward contract or futures contract can allow both trading partners to lock in future prices for the grain. The party wishing to lock in a purchase price for wheat could take a long position in a forward or futures contract and the party wishing to lock in a selling price takes a short position in a forward or futures contract. The futures contract, for example, obliges each of its participants to transact for wheat at the agreed upon price (settlement price) on the settlement date. However, since the manufacturer never knows exactly whose wheat it will purchase, and the farmer never knows exactly who the end user of his wheat will be, they simply take positions in futures contracts with seemingly anonymous counterparties. The clearing house is the counterparty for each futures transaction. Although the farmer actually sells wheat at the prevailing market price at harvest, his short position in the futures contract enables to him offset decreases (increases) in the market price of wheat with gains (losses) in his short position in the futures contract. Similarly, the cereal manufacturer purchases wheat at the prevailing market price at harvest, though its long position in the futures contract enables to him offset increases (decreases) in the market price of wheat with gains (losses) in its long position in the futures contract.

3. A securities marketplace can become recognized as an exchange in the United States by fulfilling government (S.E.C.) regulatory requirements in orderly to duly register with the government (S.E.C.) as an exchange. That is, a U.S.-based marketplace becomes an exchange by filing a successful application to become recognition as an exchange by fulfilling S.E.C. requirements.