DERIVATIVES MARKETS

DAVID H. GOLDENBERG

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ROUTLEDGE

DERIVATIVES MARKETS

Derivatives Markets is a thorough and well-presented textbook that offers readers an introduction to derivatives instruments, with a gentle introduction to mathematical finance, and provides a working knowledge of derivatives to a wide spectrum of market participants.

This new and accessible book provides a lucid, down-to-earth, theoretically rigorous but applied introduction to derivatives. Many insights have been discovered since the seminal work in the 1970s and the text provides a bridge to these insights, and incorporates them. It develops the skill sets needed to both understand and intelligently use derivatives. These skill sets are developed, in part, by using concept checks that test the reader's understanding of the material as it is presented.

The text discusses some fairly sophisticated topics not usually discussed in introductory derivatives texts; for example, real-world electronic market trading platforms such as CME's Globex. On the theory side, there is a much-needed and detailed discussion of what risk-neutral valuation really means in the context of the dynamics of the hedge portfolio.

The text is a balanced, logical presentation of the major derivatives classes including forward and futures contracts in Part 1, swaps in Part 2, and options in Part 3. The material is unified by providing a modern conceptual framework and exploiting the no-arbitrage relationships between the different derivatives classes.

Some of the elements explained in detail in the text are:

- Hedging, Basis Risk, Spreading, and Spread Basis Risk.
- Financial Futures Contracts, their Underlying Instruments, Hedging and Speculating.
- OTC Markets and Swaps.
- Option Strategies: Hedging and Speculating.
- Risk-Neutral Valuation and the Binomial Option Pricing Model.
- Equivalent Martingale Measures: A Modern Approach to Option Pricing.
- Option Pricing in Continuous Time: From Bachelier to Black-Scholes and Beyond.

Professor Goldenberg's clear and concise explanations, running concept checks, and end-of-chapter problems guide the reader through the derivatives markets, developing the reader's skill sets needed in order to incorporate and manage derivatives in a corporate or risk management setting. This textbook is for students, both undergraduate and postgraduate, as well as for those with an interest in how and why these markets work and thrive.

David H. Goldenberg is an independent researcher in New York, USA.

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David H. Goldenberg

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CONTENTS

DETAILED CONTENTS

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FIGURES

TABLES

PREFACE

Derivatives Markets offers readers a modern introduction to derivatives instruments and it provides the tools needed in order to develop a *working* knowledge of derivatives. The idea of this text is to present a down-to-earth, yet theoretically rigorous and applied introduction to derivatives. It also presents a gentle introduction to mathematical finance, which is needed in order to understand modern (post-1970s) developments.

In order to understand the approach of this text, a brief discussion of the history of derivatives is useful. Many insights about derivatives have been discovered since the seminal work in the 1970s, and the text provides a bridge to and incorporates those insights. It develops the skill sets needed both to understand and intelligently use derivatives. These skill sets are developed, in part, by using concept checks that test the reader's understanding of the material as it is presented.

The text discusses some fairly sophisticated topics, *not* usually discussed in introductory derivatives texts; for example, real-world electronic market trading platforms such as CME's Globex, an understanding of which is needed in order to understand other worldwide electronic trading systems. On the theory side, a detailed discussion of what risk-neutral valuation really means in the context of the dynamics of the hedge portfolio is provided for the simplest option pricing model.

A balanced, logical presentation of the major derivatives classes is given. This includes: Forward and futures contracts in Part 1; Swaps in Part 2; and Options in Part 3. The material is unified by providing a modern conceptual framework and exploiting the no-arbitrage relationships between the different derivatives classes.

The goals of the text are to guide the reader through the derivatives markets; to develop the reader's skill sets needed in order to incorporate and manage derivatives in a corporate or risk management setting; and to provide a solid foundation for further study. This textbook is for students, both undergraduate and graduate, as well as for those with an interest in how and why these markets work and thrive.

TO THE STUDENT

Concept checks and end-of-chapter exercises are an integral part of this text. I suggest that you do the concept checks as you go along. Selected solutions have been presented at the end of the chapters. Solutions to the other concept checks can be attempted through discussion with your colleagues, and/or with the help of the instructor.

Another feature of the text is its emphasis on '*the quote mechanism*'. Frequent references to the Internet are made so that you can see the world of data that underlies derivatives markets. Most of the websites are fairly stable and therefore should be valid when you read this text. Keep in mind, though, that the Internet changes rapidly. These websites will be updated on the textbook's website (see below).

Finally, there is no royal road to understanding derivatives markets, other than effort on your part. If there were such a royal road, then many more people would understand derivatives than actually do. That would reduce the applied value to you of studying the subject. Some students have gone on to careers in the derivatives field. You don't have to be a rocket scientist in order to learn derivatives. Much more important is that you simply put the required effort into properly learning the material.

STUDENT RESOURCES

The textbook's website is https://www.routledge.com/products/9780415599016. There you can find useful resources to aid in understanding the material. This includes the websites referred to in the text, (updated) data sources, a list of errata, and other materials which will be added over time.

TO THE INSTRUCTOR

The text is suitable for a one-semester course on derivatives at the undergraduate level or at the graduate level. If time is at a premium, Chapters 8, 15 and 17 can be omitted. Or one could cover swaps in Chapter 8 and omit Chapters 15, 16 and 17. You should be able to cover the remaining 14 chapters in a normal semester. Ancillaries for adopters will be provided on an appropriate password-protected website.

Pedagogical features are included, and these include the Concept Checks. Most of these are straightforward, and the ones for which solutions have not been provided at the end of the chapters can be used as 'talking points'.

Further, I have tried to make the end-of-chapter exercises both relevant and interesting. I also use redundancy as a pedagogical tool to show the reader how the concepts apply in different contexts.

On the issue of starting with forwards vs. starting with options, I have selected the former. Forward contracts seem to be an easier means of entry into the subject matter. Options, on the other hand, are more nuanced financial instruments. As noted above, modern research insights on derivatives have been incorporated. Some of these have already made their way into the pedagogical literature. But some have not because they have been viewed as too mathematical for the student to be able to understand.

I do not share this view, but rather believe that many of the insights of modern finance (including derivatives), if given the appropriate economic intuition and an understanding of ordinary calculus, are well within the grasp of the intelligent reader. Certain topics in derivatives border on rocket science, but many topics do not. Along these lines, I have tried to provide *all* the details necessary to understand the material—because many students, and instructors, know that 'the devil is in the details'.

Some of the highlights of the text are:

1. an emphasis on the *quote mechanism*, and understanding where to find and how to read and interpret the data that underlies this field;
2. an early presentation of the *hedging role of forward contracts* in Chapter 2, with the use of Microsoft Excel charts as visual aids;
3. an early emphasis on FX markets to develop a *global* perspective, as opposed to the usual stock market focus;
4. separating out forward contract valuation in the no-dividend case from the dividend case, as exemplified in Chapters 3 and 4;
5. recognizing the *alternative* derivative valuation problems: at initiation, at expiration, and at an intermediate time;
6. an emphasis on *market microstructure* in Chapter 5 on futures markets, with due attention to the limit order book and Globex;
7. a *portfolio* approach to hedging with futures contracts in Chapter 6, with a discussion of most of the approaches to hedging, including carrying charge hedging;

8. discussion of difficult to explain, yet important concepts such as *storage, the price of storage,* and the all-important *spreads* notion;
9. an extensive Chapter 7 on financial futures contracts, with particular emphasis on Eurodollar spot and futures, since these are the basis for understanding swaps in Chapter 8;
10. a complete discussion of stock index futures in Chapter 8, and their uses in alternative hedging strategies. This includes a discussion of the difference between hedging stock portfolios with forwards and hedging with futures;
11. an entry into understanding swaps, by viewing them as *structured* products, based on the forward concept;
12. the difference between commodity and interest rate swaps, and a detailed explanation of what it means to *pay fixed* and *receive floating* in an interest rate swap;
13. understanding Eurodollar futures strips, notation shifts, and the role of the quote mechanism;
14. discussion of swaps as a zero-sum game, and research challenges to the comparative advantage argument;
15. swaps pricing and alternative interpretations of the par swap rate;
16. a step-by-step approach to options starting in Chapter 9 with the usual emphasis on the quote mechanism, as well as incorporation of real asset options examples;
17. an American option pricing model in Chapter 9, and its extension to European options in Chapter 11;
18. the importance of identifying *short*, not just long, positions in an underlying asset and the hedging demand they create;
19. two chapters on option trading strategies; one basic, one advanced, including the three types of covered calls, the protective put strategy, and their interpretations;
20. a *logical* categorization of rational option pricing results in Chapter 11, and the inclusion of American puts and calls;
21. neither monotonicity nor convexity, which are usually assumed, are rational option results;
22. partial vs. full static replication of European options;
23. working backwards from payoffs to costs as a method for devising and interpreting derivatives strategies;
24. the introduction of *generalized* forward contracts paves the way for the connection between (generalized) forward contracts and options, and the discussion of American put-call parity;

25. the Binomial option pricing model, N=1, and why it works—which is *not* simply no-arbitrage;
26. three tools of modern mathematical finance: no-arbitrage, replicability and complete markets, and dynamic and static replication, and a rule of thumb on the number of hedging vehicles required to hedge a given number of independent sources of uncertainty;
27. static replication in the Binomial option pricing model, N=1, the hedge ratio can be 1.0 and a preliminary discussion in Chapter 13 on the meaning of risk-neutral valuation;
28. dynamic hedging as the new component of the BOPM, N>1, and a path approach to the multi-period Binomial option pricing model;
29. equivalent martingale measures (EMMs) in the representation of option and stock prices;
30. the efficient market hypothesis (EMH) as a guide to modeling prices;
31. arithmetic Brownian motion (ABM) and the Louis Bachelier model of option prices;
32. easy introduction to the tools of continuous time finance, including Itô's lemma;
33. Black–Scholes derived from Bachelier, illustrating the important connection between these two models;
34. modeling non-constant volatility: the deterministic volatility model and stochastic volatility models;
35. why Black–Scholes is still important;
36. and a final synthesis chapter that includes a discussion of the different senses of risk-neutral valuation, their meaning and economic basis, and a complete discussion of the dynamics of the hedge portfolio in the BOPM, N=1.

I would like to thank the giants of the derivatives field including: Louis Bachelier, Fischer Black, John Cox, Darrell Duffie, Jonathan Ingersoll, Kiyoshi Itô, Robert Merton, Paul Samuelson, Myron Scholes, Stephen Ross, Mark Rubinstein, and many others. I sincerely hope that the reader enjoys traveling along the path to understanding *Derivatives Markets*.

David Goldenberg
Independent researcher, NY, USA

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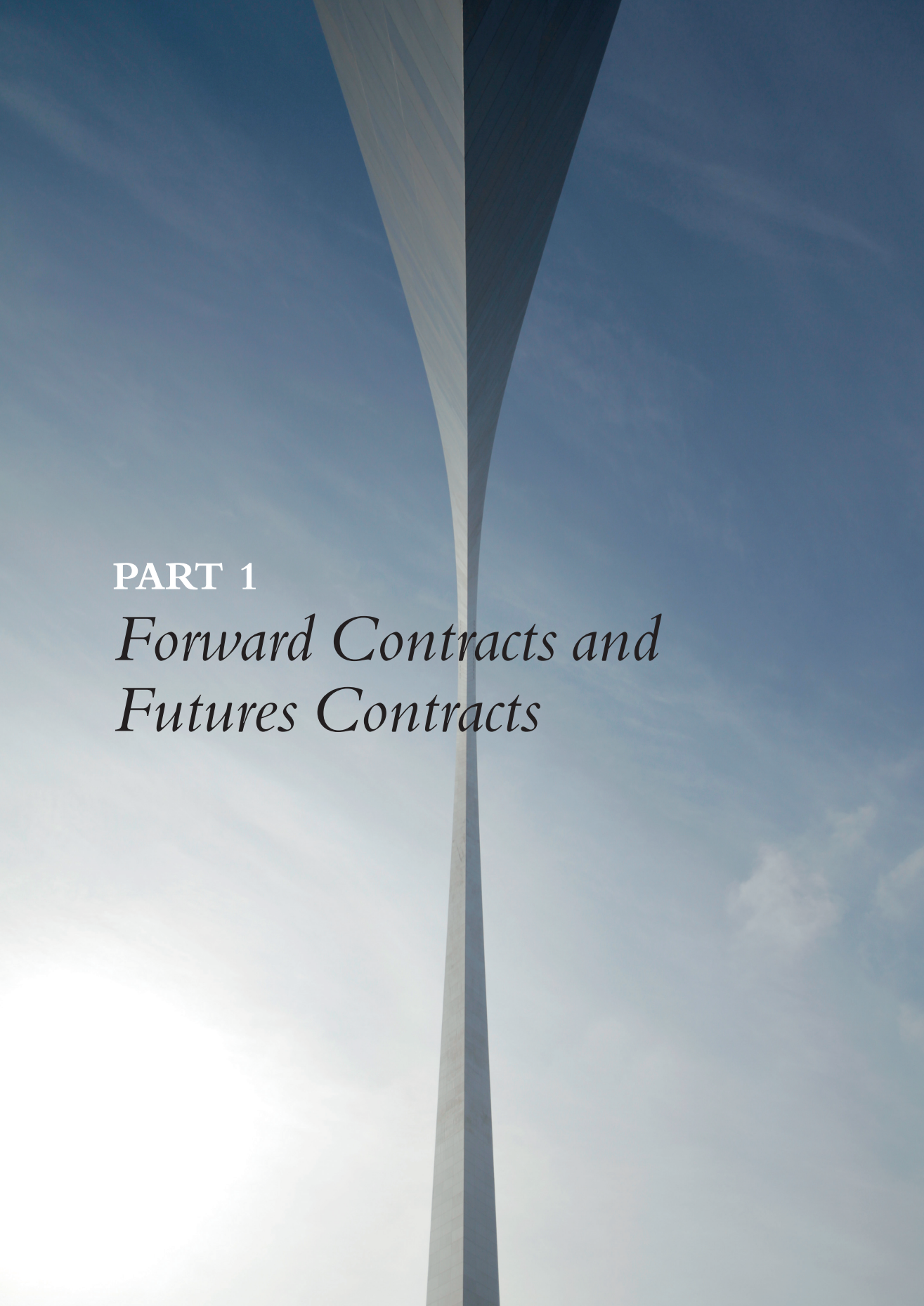

PART 1

Forward Contracts and Futures Contracts

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CHAPTER 1

SPOT, FORWARD, AND FUTURES CONTRACTING

INTRODUCTION AND MOTIVATION

You will be traveling from your home country to Canada in a month and you know that you will need to obtain Canadian dollars to use while in Canada. To get an idea of the risk you face, you decide to look at the Canadian/US dollar exchange rate. Indeed, over the past year it has fluctuated with parity occurring around May 2013. The risk to you is that you may have to pay *more* for Canadian dollars in a month than you would pay today. Of course, it is possible that you could pay less in a month.

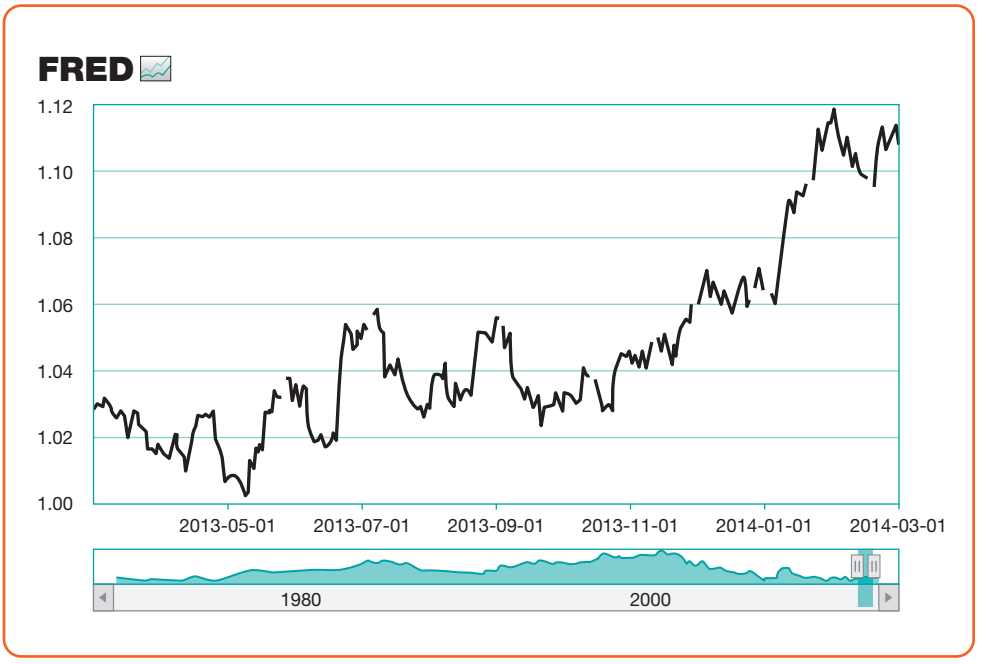
The problem is that you do not know today whether your currency will depreciate or appreciate relative to the Canadian dollar. You face currency (foreign exchange=FX) risk. Figure 1.1 indicates how many Canadian dollars were contained in 1 USD$ over the period March 2013–March 2014. This is what is meant by USD/CAD.

It is defined as USD$1/(US Dollar Value of 1$CAD), and describes how many Canadian dollars it takes to buy 1 US dollar, or how many Canadian dollars are 'in' 1 US dollar, or the Canadian dollar price of 1 US dollar.

For example, the CAD dollar price of 1 US dollar was approximately 1.1 Canadian dollars in March 2014. By solving USD$1/(US Dollar Value of 1$CAD)=1.1 for the denominator, this translates into the US dollar value of 1CAD$ of USD$ 0.90. You can see from this example that understanding the 'quote mechanism' is important. Are we quoting Canadian dollars in terms of US dollars, or are we quoting US dollars in terms of Canadian dollars? Understanding the quote mechanism is an essential prerequisite for being able to intelligently deal with derivatives and the instruments that underlie them.

One Canadian dollar was worth 0.90 US dollars in March 2014. A move upward (downward) in the USD/CAD ratio indicates that the Canadian dollar is depreciating (appreciating), because there are more (fewer) Canadian dollars in 1 US $. If it takes *more* Canadian dollars to purchase 1 US dollar, then the Canadian dollar is *depreciating* relative to the US dollar. Another way to put

FIGURE 1.1 Canada/US Foreign Exchange Rate



Source: *St.* Louis Fed, reprinted with permission.

this is that if 1 US dollar buys more (fewer) Canadian dollars, then the Canadian currency is weakening (strengthening) relative to the US dollar. Alternatively, more USD in a single CAD dollar means that the CAD is appreciating relative to the USD dollar.

1.1 THREE WAYS TO BUY AND SELL COMMODITIES

What are your alternatives today to try and manage the foreign exchange risk you are certain to experience? To answer this important question we first examine the ways in which you can transact in a foreign currency. There are three main ways. You could transact:

1. In the *spot* (*cash*) market;
2. in the *forward* market, or;
3. in the *futures* market.

1.2 SPOT MARKET CONTRACTING (MOTIVATION AND EXAMPLES)

What does it mean to transact in the spot market? The easiest way to think about this is as a *cash and carry* transaction. You go out and buy something for immediate delivery and you pay the going price in the market. For example, you fill your car's gas tank with gasoline. When you do so, you pay the (posted) spot price of gasoline even though the theoretical spot price determined in the spot market for gasoline keeps changing, based upon demand and supply conditions. Most of our purchases are of this form, but there are some notable exceptions.

Let's formalize the idea of spot markets and spot transactions.

Spot (Cash) refers to the characteristic of being available for immediate or nearly immediate delivery. Other features are:

- No standardized contract;
- no organized exchange in which trading necessarily takes place;
- commodities underlying spot transactions may have different grades (quality levels);
- the terms of a spot agreement are tailor-made to suit the parties to the agreement.

These terms include:

a. Grade;
b. time of delivery. Financial instruments sold in the spot market usually have a 0-day to 3-day delivery window;
c. place of delivery;
d. other terms as suit the parties.

A *spot transaction* is one in which two (counter)parties engage in a transaction for immediate or nearly immediate delivery of some commodity.

The *spot market* is the (not necessarily organized) market in which spot transactions take place. It is an abstract entity. The spot market is just the set of all spot transactions.

The *spot price* of a commodity, at a point in time, is the price agreed upon for purchase and sale of the commodity under such terms as the two counterparties agree upon. Delivery is immediate, or nearly immediate.

Price Quotes in Spot Markets

We will look at spot prices in the FX (Foreign Exchange) market. A useful source for data is the *Wall Street Journal*, online.wsj.com. Go to that page and click '*Markets*'. One of the categories listed is '*Market Data*'. Having reached this point, click *FX*. You will see a tab titled '*New York Closing*' under '*Complete Currencies Data*'. This takes you to '*Exchange Rates: New York Closing Snapshot*'. This gives spot and some forward prices for most of the world's major currencies.

Usually, forward '*prices*' are called forward *rates* because they show you how to convert from one currency to another.

As a concrete example, on the quote date March 11, 2014, according to this source, the going spot price of one UK (British) Pound was USD$1.6617. Inverting this, we quickly see that USD1$ would buy 0.601793 British Pounds. We will delve into FX in much more detail in Chapter 4.

CONCEPT CHECK 1

(*Solutions for selected Concept Check questions are at the end of the chapters*)

Choose the quote date–March 11, 2014–look at the FX price quotes at online.wsj.com and answer the following questions (you can even download

the entire data set into Excel.) Historical data is available from 'Find Historical Data', and it apparently goes back to May 1, 2007.

a. Which currencies have forward price quotes, in addition to spot FX price quotes?
b. Find the euro. How many US dollars does it take to buy one euro in the spot FX market?
c. How many Euros were in 1 US dollar on the quote date?

1.3 FORWARD MARKET CONTRACTING (MOTIVATION AND EXAMPLES)

Consider a potential homeowner who goes to a financial institution to raise part of the capital needed to purchase a home. This is done by borrowing from a financial institution, who therefore acts as the lender. To do so, he *issues (sells)* a fixed-rate mortgage.

Home buyers have to arrange mortgage financing *before* they close on a property. But most of them do not want to assume the interest rate risk associated with long-term fixed-rate mortgages. That is, if home buyers waited the customary 30 or 60 days to lock in the interest rate on their loans, then they might have to pay a *higher* interest rate than the one currently prevailing. To prevent this from happening, home buyers arrange for financing in *advance at a fixed rate*.

This means that they take a *short position* in a forward contract which enables them to fix the long-term mortgage interest rate that they will pay. The homeowner has a short forward position because he wishes to *borrow* by *issuing* (selling) the mortgage bond, but in advance at the forward rate.

Then, when the mortgage is actually issued, he will pay a fixed rate for, say, 30 years. He is in a scenario where, no matter what happens to long-term mortgage interest rates in the 30 to 60 days before closing, he has *locked* in a rate. This rate is called the 30 (60) day forward rate on the long-term mortgage interest rate.

A financial institution, such as Bank of America, that invests in this forward mortgage (lender) is *buying* the forward contract. That is, it is *buying forward* the long-term mortgage bond and thereby receiving the fixed monthly mortgage payments. As such, it assumes the risk that long-term mortgage interest rates will increase over the subsequent period in which the rate is locked in.

The risk to the financial institution arises because, if interest rates actually do rise, then they could have charged the homeowner a higher interest rate. By locking in the forward rate in advance, they lose the present value of the interest that would have been earned over 30 years had they charged the higher spot mortgage interest rate. This is a substantial problem for financial institutions and is one reason they may favor the variable-rate mortgages that played a notorious role in the financial crisis of 2007–2008.

Forward contracts are useful, and were one of the first types of derivatives to be used in ancient times. In the olden days, Japanese rice farmers used forward contracts to lock in the price of their subsequent crops. This helped them to manage the risk of being in the rice production business. The ability to contract in forward markets is the second way that one can purchase a commodity. Its usefulness becomes readily apparent.

Forward refers to the characteristic of being available for delivery at some future time, at a *fixed* price determined today. Features of this mode of contracting include:

- No standardized contract;
- no organized exchange in which trading necessarily takes place;
- commodities underlying forward contracts can have different grades (quality levels) because they are just spot commodities;
- the terms of a forward agreement are tailor-made to suit the parties to the agreement.

These terms include:

a. Grade;
b. time of delivery;
c. place of delivery;
d. other terms as suit the parties.

A *forward transaction* is one in which two (counter)parties agree to purchase and sell a commodity at some future time, under such terms as they mutually agree upon. Basically, a forward transaction shares almost all the characteristics of a spot transaction. As such, it is a *deferred spot market* transaction at the forward price.

The *forward market* is the (not necessarily organized) market in which forward transactions take place. It is an abstract entity. The forward market is just the set of all forward transactions.

The *forward price* of a commodity is the price agreed upon today for purchase and sale of the commodity to be delivered at the specified future date. No monies are initially exchanged at the origination of the forward contract. Delivery and payment are deferred. There is one exception, and that is a *pre-paid* forward contract.

Price Quotes in Forward Markets

We can easily illustrate forward mortgage rates using online.wsj.com once again.

CONCEPT CHECK 2

(*Exploring forward rates in the long-term mortgage market*)

Start from the online.wsj.com home page. Go directly to '*Market Data*'. Then to '*Rates*', then to '*Bonds, Rates, and Credit Markets*'. Under '*Complete bonds, rates and credit markets data*' you will find '*Benchmarks and comparisons*'; scroll down until you encounter the link for '*Money Rates*' and click it. Then scroll down to Fannie Mae 30 year mortgage yields and you will see a price quote that looks like that in Table 1.1. The data you will see is the latest when this exercise is done. Included in that data, but not in our Table 1.1, are the 52-week high and low rates.

Look up the historical data for March 7, 2014.

TABLE 1.1 Forward Mortgage Rates (March 7, 2014)

Forward 30-year fixed-rate mortgage rates	03/07/2014	02/28/2014
30 days forward	3.96202	3.89237
60 days forward	4.00284	3.93017

Table compiled by the author from data available at www.fanniemae.com/singlefamily/historical-daily-required-net-yields (last accessed May 27, 2015).

a. Do you find the same data as in Table 1.1 there?
b. What were the 52-week high and low rates?
c. Do you see substantial *volatility* in forward mortgage rates over the one-year period?

These are Fannie Mae's 30-day forward rates for 30-year fixed-rate mortgages and the 60-day forward rates for 30-year fixed-rate mortgages. Note what is happening here. The quote date was March 7, 2014. We are in the forward market, because it is locking in mortgage rates for delivery in 30 and in 60 days, no matter what happens in 30 or in 60 days. This is a fantastic thing to be able to do and is precisely what the forward market offers.

Using forward markets in this way, you can manage the interest-rate risk that you would otherwise assume between the time you arrange financing in the mortgage market and you close on the property (typically in 30 or in 60 days). If you did not contract in the forward market, but took your chances in the spot 30-year mortgage market, then in 30 or 60 days you would have to take the going rates. Things could turn out quite badly if 30-year mortgage rates spike in 30 or in 60 days. Of course, rates could *decline* as well. But the average consumer is not in the business of predicting long-term interest rates.

This is something that even professionals have difficulty with, due to the efficiency of interest rate markets, which implies unpredictability. The average consumer probably wants to more or less effectively manage his/her life by locking in a 'reasonable' rate. For reference, anything under 5% is low by historical standards.

It is also important to understand the spot mortgage market. To construct Table 1.2, we will take a direct route to the spot 30-year fixed-rate mortgage market, which are weekly average rates. We will take the week of March 6, 2014 and the week of Feb 27, 2014. The data, available from www.freddiemac.com/pmms/archive.html?year=2014 (accessed May 27, 2015), is given in Table 1.2.

TABLE 1.2 Weekly Average Spot 30-Year Fixed Mortgage Rates

	Week of March 6, 2014	Week of Feb 27, 2014
30-year fixed mortgage rate (weekly average)	4.28%	4.37%

Table compiled by the author from Freddie Mac's Mortgage Market Survey Archive, Compilation of Weekly Survey Data for 2014, www.freddiemac.com/pmms/archive.html?year=2014 (last accessed May 27, 2015).

CONCEPT CHECK 3

(*Exploring spot rates in the long-term mortgage market for available data*)

Go back to *Bonds, Rates, and Credit Markets*. Instead of going to '*Money Rates*' simply scan the page for '*Consumer Rates*', which were taken from bankrate.com, the key consumer bank rate quote mechanism. The data there is based on base rates posted by 70% of the nation's largest banks from their source which was SIX Financial Information, WSJ Market Data Group, and Bankrate.com.

a. Discuss the spot 30-year mortgage rates you find at the site for a specific date you choose. Note that historical data is not available for Consumer Rates on online.wsj.com. That's why we went to the source Freddie Mac in Table 1.2.

Be careful in using online databases, and don't expect to get the same numbers from different databases. One has to look carefully into how price and rate quotes from different sources are determined. For example, bankrate.com uses *overnight* averages and explains them on their site. Do not assume that quotes from different sources are directly comparable to the second decimal place.

Rather, these kind of publicly available quotes are intended to give an idea of the *level* of the market, rather than the *precise* market. In the case of 30-year mortgages, they differ by lending institution and locality. That's why bankrate.com asks for zip codes to offer local borrowing rates in one's area.

1.4 PROBLEMS WITH FORWARD MARKETS

Forward markets serve an important risk management function. But they are not without their flaws. There are two main problems associated with forward contracts and with the structure of forward markets.

Since forward contracts are bilateral contracts directly between individuals, and delivery and payment is deferred, there is *counterparty* risk. This could happen if either party to the forward transaction does not honor his obligation. Note that forward contracts are not options, one is *required* to make (take) delivery of the commodity at the specified date.

Why would someone default on such an agreement? Generally, default becomes a real possibility when there are *incentives* to default. If I agree to sell a commodity at a *fixed* price three months down the road, then I have *locked in* that price. If the price rises in the meantime, then I suffer an opportunity loss if I honor my commitment.

Case Example: SouthWest Airlines

As an example, suppose that Southwest Airlines is worried about fuel cost containment. The price of jet fuel could precipitously rise in 3 months. If Southwest waits 3 months to buy jet fuel, then it would have to pay the spot price at that time.

Alternatively, Southwest could simply *buy* a 3-month forward contract in the forward market for jet fuel and lock in the 3-month forward jet fuel price today. This would certainly achieve its objective of cost containment, *if* the price of jet fuel rises in 3 months.

But suppose that jet fuel becomes *cheaper* in 3 months. Suppose that the spot price falls below the locked-in forward price. Then Southwest would have to buy jet fuel at a forward price that exceeds the spot price in 3 months. This could cost it massive amounts of money. It clearly has an incentive to default in order to minimize its ultimate cost of jet fuel.

Considerations such as these make companies think twice before they make forward commitments. The downside of thinking too much about these issues is that it biases management to take speculative positions. We will discuss hedging and speculation, and the difficulty of drawing a hard and fast line between them, in this text.

CONCEPT CHECK 4

a. Did Southwest lose out by entering into the forward contract in the first place?

A similar argument could be given from the point of view of the *seller* of jet fuel forward contracts. If the spot price *rises* above the agreed upon 3-month forward price, then the seller of the forward contract has an incentive to default.

In case any of this appears to be academic, note that over the counter (OTC) markets tend to have this feature of counterparty risk. The credit default swaps

market is a notable example, allegedly playing a role in the 2007–2008 financial crisis.

This suggests that market organization is important. A financial instrument can play an important and useful risk management role, but the way the market is organized can create havoc.

How can counterparty risk be controlled? One way is to *know* the counterparty. For example, in the forward exchange (FX) market the major players are banks with known reputations. Clearly, a bank could default on its forward market commitments if they are likely to put it out of business. Short of this, banks tend to worry about their reputations. This counteracts counterparty risk in the FX market.

Another way to control counterparty risk is to change the very structure of the market while keeping its basic economic functionality intact. The basic problem with forward markets appears to be the lack of an exit mechanism. If market participants could somehow fulfill their financial obligations and exit the market before the delivery date, then they would have the best of both worlds. This is the idea behind futures markets.

Let's summarize the problems with forward market organization. As currently organized, forward markets are delivery markets. Cancellation by one party to the contract may be impossible or involve penalties. Having contracts between individuals allows *customization* but opens the door to counterparty risk.

Forward contracts are typically customized products, and are not standardized. This lack of standardization of forward contracts makes them harder to trade in a liquid, secondary market. Basically, forward contracts are just like spot contracts, except that payment and delivery is deferred. One receives and pays for the commodity only at delivery.

1.5 FUTURES CONTRACTS AS A SOLUTION TO FORWARD MARKET PROBLEMS (MOTIVATION AND EXAMPLES)

Spot and forward contracting occur in markets that are known as OTC (over the counter). This means that transactions are essentially between individuals. What other ways could transactions occur?

The brief answer is that they could be *intermediated*. This means that some third party intervenes. Then, there is an alternative to you being the buyer (seller) to the seller (buyer), as in OTC markets. You could be the buyer (seller) to the intervening third party.

This third party would then assume two roles. First, it would be seller to the buyer. At the same time, it would be buyer to the seller. In the case of futures markets, the third party is the *Clearing House*.

Why such a complex, seemingly circular market organization? Indeed, according to the popular wisdom, doesn't it pay to 'eliminate the middleman'? It turns out that there are advantages to having a properly defined middleman in the case of forward/futures markets.

Organized futures markets are a clever way to solve the illiquidity and counterparty risk problems of forward markets, while keeping the basic economic function of forward contracting intact. That function is to *lock in* today a forward price at which deferred transactions take place.

Organized futures markets accomplish these goals by first standardizing futures contracts. This is a necessary condition in order to have a liquid secondary market. It is very difficult to trade a financial product that is highly customized for the needs of particular customers. One can initiate trades in them, of course. Otherwise, OTC markets would not exist. The question is how to *exit* a trade once initiated.

Standardization is a big step towards providing liquidity. If the futures contract that all buyers and sellers trade is a homogeneous financial contract, then they could be traded just like US dollar bills or any of the world's currencies. However, the problem of counterparty risk still remains. To move towards resolving this, organized futures markets introduce a *clearing house*. In futures markets, the clearing house has a set of critical economic functions.

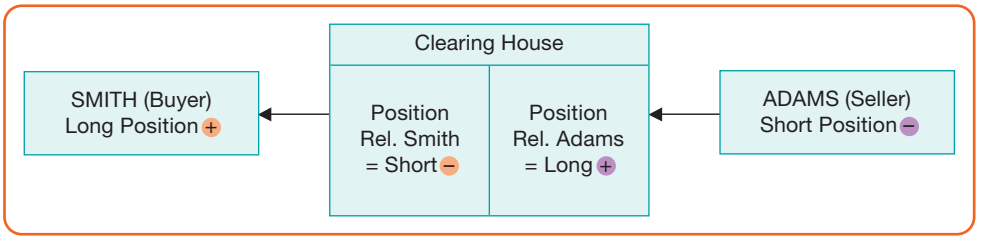
The first role of the clearing house in futures markets is to *intermediate* all trades.

Example 1 (Intermediation by the Clearing House)

Suppose that a buyer named Smith submits a buy order for 10 futures contracts. At the same time, a seller named Adams submits a sell order for 10 of the identical contract. These orders are executed through the trading process on the floor of a futures exchange, or electronically.

In normal bilateral transactions, Smith would be buying directly from Adams. This is not so in futures markets, because the clearing house steps in between Smith and Adams. Now Smith is buying from the clearing house, who acts as the seller. Adams is selling to the clearing house, who acts as the buyer. The picture is as follows in Figure 1.2.

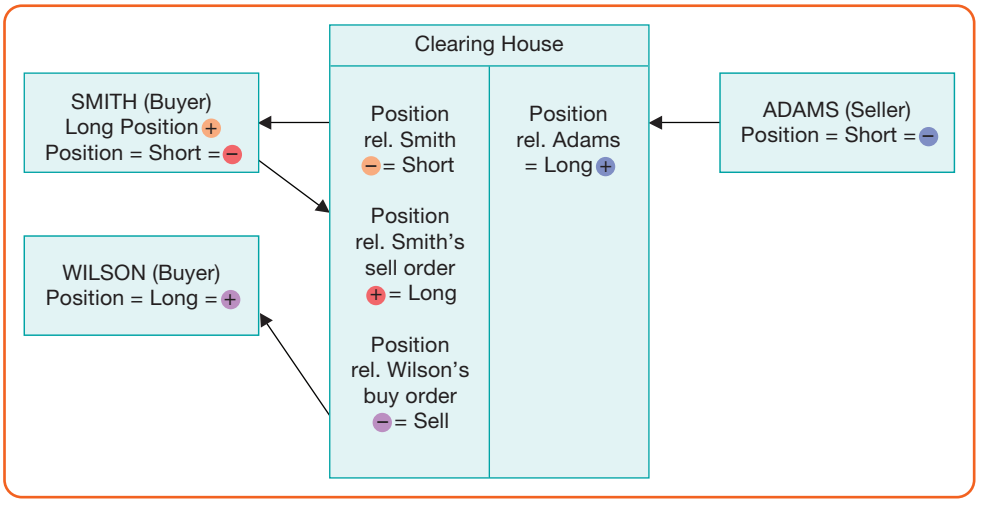
FIGURE 1.2 Intermediation by the Clearing House



Example 2 (The Exit Mechanism)

This somewhat unfamiliar market structure makes it possible for both Smith and Adams to exit the market by 'reversing' their trades. Suppose that Smith wants to exit the market. Provided that Smith fulfills the financial obligations created by his initial long futures position, there is no reason that he cannot exit. He simply submits a sell order in the identical futures contract. In a liquid market that order will be matched with the buy order of another market participant, let's say named Wilson. After the transaction, the picture is Figure 1.3.

FIGURE 1.3 Offsetting Trades



Note that the direction of the arrow indicates the commodity flow. Take Smith's long position. Smith initially is obligating himself to take delivery of the commodity underlying the futures contract. Hence the arrow points towards Smith.

CONCEPT CHECK 5

a. Why does the arrow point away (towards the clearing house) from Adams?

The rather complicated diagram in Figure 1.3 illustrates the exit mechanism incorporated into futures markets. By making a reversing trade, Smith has essentially exited the market. Smith has two arrows based upon his two trades.

The first points toward him because he went long and incurred the obligation to *take* delivery of the commodity underlying the futures contract.

Later he went short, thereby incurring the obligation to *make* delivery of the underlying commodity. It would be redundant to actually force Smith to take delivery and then to turn around, and make delivery of the commodity. As long as Smith covers the financial implications of his trade, he is out.

What happened to Adams? Did Smith just default on him? Not at all. Note that the contract is *not* between Smith and Adams. It is between Smith and the clearing house. And it is between Adams and the clearing house. So, even if Smith defaulted (which he did not), the clearing house would pick up the slack and honor its obligation to Adams as buyer to the seller.

This, of course, would be a major difficulty for the clearing house, and it is not necessary. Wilson has entered the market as a buyer and Smith's original obligation as the buyer has effectively been *transferred* to Wilson. The clearing house is in the clear as it were; it is long to Adams and short to Wilson. In case of delivery, it could require Adams (as seller) to deliver the commodity and it could redeliver it to Wilson (as buyer). Everyone is happy.

Liquidity has been enabled. Think of it this way: if you buy 100 shares of IBM stock and then sell them you have exited the market. The person who bought your shares is the new owner. Here the commodity is not actually being bought or sold as in a spot transaction. Rather, the *obligations* to buy and sell the commodity at prices fixed today for subsequent delivery are being transferred. This is slightly more abstract but the same concept.

Note that if the contract was directly between Smith and Adams, then this tricky reversing-out transaction would be difficult or impossible. Smith would have to ask Adams for permission to exit his obligation and, if Adams gives such permission, then Smith would have to find someone else to whom to transfer Smith's buy obligation. In practice, due to the potential difficulty of exit, forward markets are less liquid than futures markets.

1.6 FUTURES MARKET CONTRACTING

The following is a key definition and should be committed to memory:

> A *Futures Contract* is a standardized agreement between a *buyer* and the clearing house of an organized exchange to *take delivery* of a specified quantity and quality of a commodity and between a *seller* and the clearing house of an organized exchange to *make delivery* of a specified quantity and quality of a commodity. Delivery is deferred and occurs during specified periods (delivery months), according to the rules of the futures exchange in which the specific futures contract is offered for trading.

The main thing to note here is that, unlike OTC forward and spot market transactions, every futures transaction is intermediated by the exchange's clearing house as illustrated in example 1.

Note that there is flexibility built into the contract with regard to quality, time, and place of delivery. These are called *seller's options*. However, all terms of the contractual futures contract are specified in the contract itself, except for the futures price at which people are contracting for delivery of the commodity. This is determined either on the floor of an organized futures exchange or electronically, depending on what trading venue the futures trade was executed.

A *futures transaction* is one in which two parties agree to purchase and sell a commodity at some future time under the terms (*contract specifications*) of the futures contract.

The *futures market* is the organized market in which futures transactions take place. It is not an abstract entity.

The *futures price*, at a given point in time and associated to a futures contract, is the price determined either on the floor of an organized exchange or electronically through the trading process.

Price Quotes in Futures Markets

We will go back to our earlier example of the British Pound. Let's say you want to buy British Pounds forward for delivery in September 2014. The current date we will assume is March 11, 2014. We go to www.cmegroup.com

and hit the button for FX. Then '*View all FX products*' and find '*British pound futures*'.

The first step in understanding futures markets is to remember that a futures contract is a standardized financial instrument. It is the same for everyone. The terms of any futures contract traded on an organized exchange is given in 'contract specifications'.

Hit the contract specifications tab under British Pound futures. You will find something like Table 1.3 (the exchange can change contract specifications as it sees fit).

TABLE 1.3 GBP/USD Futures

Contract Size	62,500 British pounds.
Contract Month Listings	Six months in the March quarterly cycle (Mar, Jun, Sep, Dec).
Settlement Procedure	Physical delivery.
Position Accountability	10,000 contracts.
Ticker Symbol	CME Globex Electronic Markets: 6B.
Open Outcry:	BP.
Minimum Price Increment	$.0001 per British pound increments ($6.25/contract).
OPEN OUTCRY (RTH)	7:20 a.m.–2:00 p.m.
GLOBEX (ETH)	Sundays: 5:00 p.m.–4:00 p.m. Central Time (CT) next day. Monday–Friday: 5:00 p.m.–4:00 p.m. CT the next day, except on Friday–closes at 4:00 p.m. and reopens Sunday at 5:00 p.m. CT.
CME ClearPort	Sunday–Friday 6:00 p.m.–5:15 p.m. (5:00 p.m.–4:15 p.m. Chicago Time/CT) with a 45-minute break each day beginning at 5:15 p.m. (4:15 p.m. CT).
Last Trade Date/Time	9:16 a.m. Central Time (CT) on the second business day immediately preceding the third Wednesday of the contract month (usually Monday).
Exchange Rule	These contracts are listed with, and subject to, the rules and regulations of CME.
Block Trade Eligibility	Yes. View more on Block Trade eligible contracts.
Block Trade Minimum	100 Contracts.
EFP Eligibility	Yes. View more on EFPs.

Source: www.cmegroup.com, reprinted with permission from CME Group Inc., 2014.

The main characteristics of this contract for our purposes are first contract size which is 62,500 BP. Contract size refers to the spot commodity underlying the futures contract. The delivery dates are six months in the March quarterly cycle (Mar, Jun, Sep, Dec). Delivery is physical, which we will discuss later.

Under 'Trading Hours', you will see the venues in which these contracts are traded. The first is by open outcry on the floor of the CME Group in Chicago. The second is on the CME Group's electronic trading platform called Globex. Most importantly, the futures price quote is in US dollars and cents.

Hit 'Quotes' and then 'Open Outcry Futures'. A number of headings appear including those in Table 1.4.

TABLE 1.4 GBP/USD Futures Price Quote

(16:22:56 CT 11 Mar 2014)

Month	Charts	Last	Change	Prior Settle	Open1/ Open2	High	Low	Close1/ Close2	Updated
Sep 2014		—	—	1.6603	—	1.6610	1.6610	1.6616	16:22:56 CT 11 Mar 2014

Reprinted with permission from CME Group Inc., 2014.

The four prices for which there is data (prior settle, high, low, close1/close2) in our quote are futures prices for the futures contract maturing in September 2014.

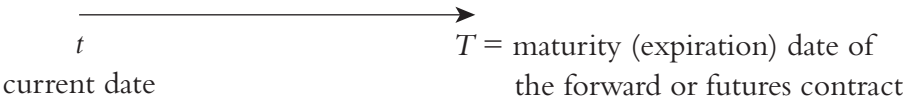
You can think of these as '*fancy forward prices*'. They are all roughly equal to US$1.661 for one BP. On the quote date of March 11, 2014 you could contract to buy or sell 62,500 BP for delivery in September 2014 at the fixed price of USD$1.661, no matter what happens in the FX market by that date.

CONCEPT CHECK 6

a. What is the commodity underlying the CME GBP/USD futures contract?
b. If you went long the Sept. 2014 contract on March 11, 2014 what would be the total US$ price at which you would be agreeing to buy the underlying commodity for?

1.7 MAPPING OUT SPOT, FORWARD, AND FUTURES PRICES

A useful tool to help us understand the forward delivery characteristic of derivatives in general is the time line. This will also be handy when we discuss hedging with derivatives.



t is the current date, sometimes written as t=0. It is the point where time starts.

T is the maturity date of the contract. This highlights the fact that derivatives are *finite-lived* instruments. Unlike common stock, they come to an end or expire. At that time, the particular contract in question has matured and it ceases to exist.

1.7.1 Present and Future Spot Prices

For example, suppose we consider the commodity gold. One of the first things to do is to search for the spot price of gold. That seems simple enough, but let's see. We go back to online.wsj.com, hit *expand* which takes you to '*Market Data*', find '*Market Data Center*', then go to '*Commodities and Futures*' and then to '*Cash Commodity Prices*' (under '*Spot Prices*').

Under '*Precious Metals, Gold*' (per Troy Oz.) you will see at least 12 different grades of spot gold, and they have different spot prices! The different grades (as of March 12, 2014) are Engelhard industrial bullion, Engelhard fabricated products, . . . , American Eagle, Troy oz.-E, and Austria Phil. This just illustrates that spot commodities tend to come in different grades.

One of the usual quote standards for Gold is the *London p.m. fixing,* which on the quote date was US$1366.00 per troy ounce. On our time line, we would call this Gold Price$_t$,

CONCEPT CHECK 7

a. What would 100 troy ounces cost at the London PM fixing (ignore transactions fees, shipping etc.)?

We are also interested in the spot gold price in 3 months perhaps because we already own gold and anticipate selling it, or we are waiting for a drop in the price of gold and wish to purchase it in 3 months.

Our time T is then 3 months from today which we could write as $T=t+3$ months. Of course, the question on everyone's mind is 'What is the spot price of gold going to be in 3 months?'.

While this is a great question, the answer is that the *future* spot price of gold (or of any volatile commodity) is a matter of speculation. No one really knows. At best, we can assign probabilities to the spot gold price being within certain ranges at the end of 3 months.

If anyone actually knew with complete certainty that the spot price of gold would be above the current price by more than carrying charges (interest, insurance, convenience yield, and storage) in 3 months' time, then they could amass huge amounts of wealth by simply investing in it, holding it for 3 months, and then selling it at the end of that time period.

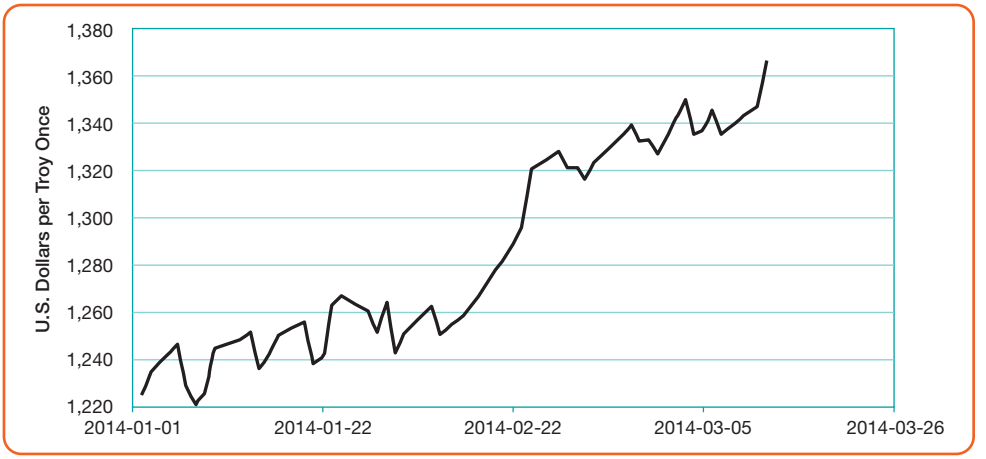
CONCEPT CHECK 8

a. Would you invest everything you have in a bet that the above scenario concerning the price of gold in 3 months would be the likely outcome?

If you believe that past commodity price behavior is a guide to future price behavior, then one piece of interesting information to at least ponder is the behavior of the spot price of gold over the *last* 3 months. Historical spot prices for London Fixing PM gold, the usual standard for the gold spot price, can be found at FRED which is the economic research department of the St. Louis Federal Reserve Bank, http://research.stlouisfed.org/fred2/series/GOLDPMGBD228NLBM (last accessed May 27, 2015). Cut and paste the link into your browser.

At this site you can make your own graphs and even download the underlying data back to April 1, 1968. Click the link and you will find a non-interactive chart in which you can select the first 3 months of data for 2014 by editing the graph.

FIGURE 1.4 Gold Fixing Price in London Bullion Market (USD$)



Source: St. Louis Fed, reprinted with permission.

The chart is reproduced above in Figure 1.4, where we took the data up to mid-March. This non-interactive chart for 01/01/2014 to 03/14/2014 shows the ups and downs of spot gold prices.

Basically, you will see that spot gold prices have had a rocky history of ups and downs over the 3-month period. Note the peaks and troughs and unpredictable *turning* points. This suggests that it is going to be very hard to predict spot gold prices over any subsequent 3-month period. That is, future spot gold prices are uncertain.

The uncertainty (volatility) in gold prices is well known to market participants. There is no reason to expect gold prices to continually go upwards or to go in any fixed direction over any period. Gold prices reflect both good (for gold) news and bad (for gold) news.

This uncertainty is partly based upon the fact that gold prices respond to many factors that in themselves are highly uncertain. These include the state of the economy, both domestic and global, and a host of other essentially unpredictable factors. Briefly, spot gold prices respond to and reflect the uncertainties of the 'market'.

CONCEPT CHECK 9

On the non-interactive charts on the FRED site look at gold prices over 1 day, 1 month, 3 months, 6 months, 1 year, 3 years, 5 years, and YTD (year to date). Notice the bumps in the longer-term charts.

a. Suppose that you are in a trough and have no further information. How do you know the trough has bottomed out?
b. Suppose that you are on a peak and have no further information. How do you know the peak has peaked?
c. What conclusions do you draw from looking at these spot gold price charts?

Going back to our time line, the gold price at expiration of the forward or futures contract is a random variable, Gold $\text{Price}_T(\omega)$. Randomness is notated by the symbol ω which in this context means 'the state of nature'. You can think of the state of nature as the state of the economy and of all the factors that affect spot gold prices.

The time line looks like this at the current date, time t.

Using the London PM fixing gold price we found on the quote date of t=03/13/2014, the gold price at time t was $1,368.750 and Gold $\text{Price}_T(\omega)$ where $T=t+3$ months from 03/13/2014 depends on what happens in the world between now and then.

We can now do this in general. We have some multi-grade commodity in which we are interested. We determine a *standard* for pricing the multi-grade spot commodity, just as we did for London pm fixing gold.

We then find the spot price of the standard spot commodity at the current date, P_t. The spot price at some future date T is a random variable, $P_T(\omega)$. It depends on economic uncertainties that are summarized by the single symbol ω.

1.7.2 Forward Prices

We can also represent forward prices using time lines, and this exercise is instructive. Foreign currencies (FX) are the easiest commodities for which to find forward prices. Go to online.wsj.com, '*Market Data*', '*Currencies*', then '*Exchange Rates: New York Closing*'. Forward prices are quoted for several currencies.

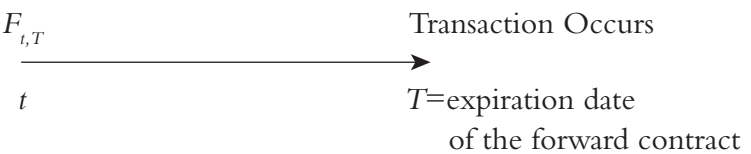
For example, on the quote date of 03/13/2014, the 3-month forward price of Japanese Yen was quoted at USD$0.00974. This means that you could engage in a forward transaction today to buy or sell Japanese yen for delivery in 3 months from the quote date for the forward price of USD$0.00974 per 1 Japanese yen.

This forward price is locked in, no matter what happens in the market between now and the delivery date 3 months from today. That is just the definition of the forward price.

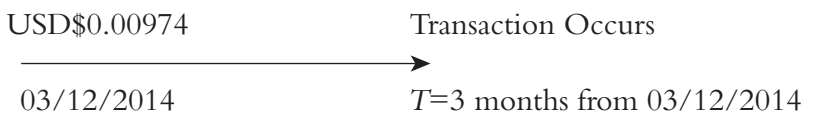
There is no uncertainty in the forward price. It is the price at which the forward transaction will ultimately take place. All uncertainty has been completely removed from the forward price. Contrast this with future *spot* prices which typically are volatile. A useful notation for the forward price today would be $F_{t,T}$.

This notation means today's (time=t) forward price for delivery of the underlying commodity at the future date time T. In our example, t=03/13/2014, T=3 months from 03/12/2014, and $F_{t,T}$=USD$0.00974 per 1 Japanese yen.

Now the question is, where does $F_{t,T}$ go on the time line? The answer is today, time t. This is because the forward price is determined in today's forward market. It then applies to the forward transaction at the expiration date of the forward contract.



For our example, this would look like,



Note that a typical forward contract could call for delivery of 12,500,000 Japanese yen at expiration (see cme.com).

CONCEPT CHECK 10

a. What price would the long (buyer) pay for the Japanese yen at expiration?

1.7.3 Futures Prices

Mapping out futures prices is basically the same as mapping out forward prices. Remember that futures contracts serve the same basic economic function as forward contracts, but are exchange-traded instruments. Futures prices are just 'fancy' forward prices.

As an example, we will use the JYen traded on the CME (see Table 1.5). Here is a price quote from March 12, 2014, where we have selected the June 2014 delivery contract. The quote date is 03/12/2014.

TABLE 1.5 JYen June 2014 Futures Price Quote (March 12, 2014)

Month	Open	High	Low	Last	Change	Settle	Estimated Volume	Prior Day Open Interest
JUN 14	9715	9756	9704	9737B	+21	9743	88,449	71,181

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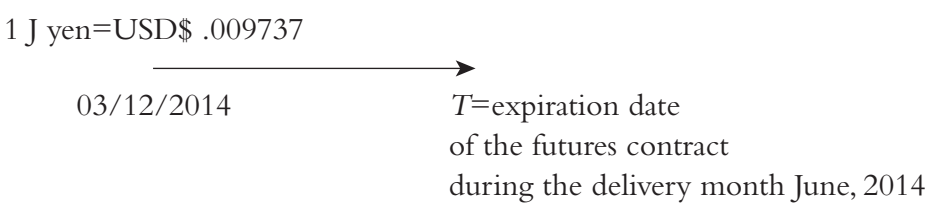
There are a number of prices quoted including open, high, low, last, and prior settlement price. Looking at the June 14 contract, the price quote of open 9715 means USD$0.009715 per 1 JYen. The last was USD$ .009737 (bid) per 1 JYen.

The time line looks exactly like the forward time line for forward prices,

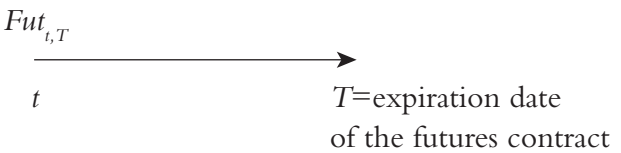


Note that the exact expiration of the contract is not specified. Only a 'delivery period' is specified. In the case of the JYen futures contract this is currently the entire delivery month of June 2014. This is in accord with 'seller's options'.

CONCEPT CHECK 11

a. What price per 12,500,000 JYen for June 2014 delivery is the long (buyer) contracting at, if he initiated a long position at the opening price on 03/12/2014?

We can do this for any futures contract. We denoted the forward price at time t for delivery of the commodity at time T as $F_{t,T}$. A futures contract is not exactly the same thing as a forward contract, and we cannot assume that futures prices are equal to forward prices, so we will call $\text{Fut}_{t,T}$ the futures price at time t for delivery of the commodity at time T.



We will delve into the operations of futures markets in Chapter 5. There is a lot to discuss, and a lot of details. Mapping out spot, forward, and futures prices is the first step because it helps us to keep track of timing considerations. It also leads to mapping out the co-movements between derivative prices and spot prices, which is the key to hedging applications.

KEY CONCEPTS

1. Three ways to buy (sell) commodities: spot, forward, and futures.
2. Spot transaction, spot market, spot price, spot price quotes.
3. Forward transaction, forward market, forward price, forward price quotes.
4. Forward market problems: counterparty risk, illiquidity.
5. Futures contracts as a solution to forward market problems.
6. Futures transaction, futures market, futures price, futures price quotes.
7. Mapping out spot, forward, and futures prices.

END OF CHAPTER EXERCISES FOR CHAPTER 1

1. (*Basic Definitions*)

   Explain the distinctions between spot, forward, and futures transactions.

2. (*Exchange Rate Calculations*)

   The following Table 1.6 gives exchange rate data for the Japanese Yen, US Dollar exchange rate.

TABLE 1.6 Japanese Yen Exchange Rate (January 30, 2014)

	Rates in currency units per US dollar
29-Jan-14	102.2000
30-Jan-14	102.8300

Source: Board of Governors of the Federal Reserve System, Foreign Exchange Rates–H.10 Country Data.

   a. How much in US dollars would 10,000,000 spot Japanese Yen be worth on Thursday, January 30, 2014?
   b. How much in US dollars would 10,000,000 spot Japanese Yen be worth on Wednesday, January 29, 2014?
   c. Did the spot Japanese Yen appreciate or depreciate relative to the USD$ from Wednesday to Thursday?
   d. Has the US dollar appreciated or depreciated vs. the Japanese Yen from Wednesday to Thursday?

3. (*Long and Short in the Forward Mortgage Market*)

   Individuals, just like corporations, issue bonds to finance investments in autos, houses, and education. These car, mortgage, and education loans create financial securities called bonds that investors can invest in.

   a. Consider the first scenario. The homeowner *already has* a 30-year fixed-rate mortgage, and is paying the interest rate on it in monthly installments that include principal and interest.
      - What would be the homeowner's primary concern in being locked into a fixed rate for 30 years?
      - Is the homeowner long or short in the spot bond mortgage market? Why?

   Hint for part a. The homeowner has issued a mortgage bond requiring him to pay the 30-year fixed rate. The value of that bond represents the present value of what the homeowner owes on that loan. Now use your knowledge of bonds to analyze what happens to that bond value as mortgage rates increase or decrease.

   b. Consider the second scenario discussed in the chapter, section 1.3. The homeowner is *considering issuing* a 30-year fixed-rate mortgage in 60 days.
      - What would be the homeowner's primary concern in this scenario?
      - Is the homeowner long or short in the spot mortgage market?
      - What position would the homeowner take in the forward mortgage-rate market? Why?

   Hint for part b. The homeowner has not issued a fixed-rate mortgage yet but is planning on doing so in 60 days. Here we can take a hint from corporate behavior. In planning to issue securities (stocks or bonds), firms want to get the greatest proceeds from the issue which is equivalent to having to pay the lowest rates (costs of capital) on those securities once issued.

   Now, analyze the effect of increasing and decreasing rates in 60 days on the homeowner *before* the mortgage bond is issued.

4. (*Global Derivatives Awareness*)

   Answer the questions based on the most recent data on (Trading) Volume Statistics, which you can find at the FIA.org (Futures Industry Association) website. You are looking for the Annual Volume Survey under Volume Statistics.

a. Identify the most actively traded derivative contracts. Consider each of the following sections separately:
   - Agricultural Futures and Options Contracts.
   - Energy Futures and Options Contracts.
   - Equity Index Futures and Options Contracts.
   - Foreign Exchange Futures and Options Contracts.
   - Metals Futures and Options Contracts.
   - Interest Rate Futures and Options Contracts.

b. What variable are the the rankings based upon?
c. Are there any other ways to rank 'actively traded' contracts?

SELECTED CONCEPT CHECK SOLUTIONS

Concept Check 1

a. On the quote date March 11, 2014 we found forward prices for the Australian dollar, the Japanese yen, the Swiss franc, and the UK pound (see Table 1.7 below).
b. One Euro was worth USD$1.3860.
c. There were 0.7215 Euros in one USD$. You can verify that 1/1.3860=0.7215.

Concept Check 3

a. When we did this exercise for March 7, 2014, we found a first entry of 4.54% which was an overnight average of the spot 30-year fixed-rate mortgage rate quoted by major financial institutions on the quote date. The second was the corresponding rate one week ago, 4.43 %. The third was the highest rate over the preceding 52 weeks, 4.80%, and the fourth was the 52-week low of 3.56%.

   As you can see by looking at the high–low spread, there was considerable volatility in mortgage rates over the one-year period ending on March 7, 2014.

Concept Check 5

a. Adams is *short* the futures contract. Therefore he has to deliver the spot commodity to the clearing house. The arrow indicates the direction of the underlying commodity flow.

TABLE 1.7 **Exchange Rates (March 11, 2014): New York Closing Snapshot**

IN US$	US$ VS.	% CHG		PER US$		
Country/currency	**Tues**	**Mon**	**1-Day**	**YTD**	**Tues**	**Mon**
Americas						
Argentina peso	0.1272	0.1272	unch	20.6	7.8635	7.8599
Brazil real	0.4233	0.4256	0.55	unch	2.3627	2.3497
Canada dollar	0.9004	0.9005	unch	4.6	1.1106	1.1105
Chile peso	0.001738	0.001756	1.05	9.4	575.47	569.50
Colombia peso	0.0004890	0.0004898	0.16	5.9	2044.80	2041.60
Ecuador US dollar	1	1	unch	unch	1	1
Mexico peso	0.0753	0.0757	0.50	1.8	13.2827	13.2161
Peru new sol	0.3567	0.3566	unch	unch	2.8034	2.8045
Uruguay peso	0.04517	0.04512	–0.11	4.5	22.1405	22.1655
Venezuela b. fuerte	0.15748031	0.15748031	unch	unch	6.3500	6.3500
Asia-Pacific						
Australian dollar	0.8976	0.9021	0.50	–0.7	1.1140	1.1085
1-mos forward	0.8957	0.9001	0.49	–0.7	1.1164	1.1110
3-mos forward	0.8921	0.8965	0.49	–0.7	1.1209	1.1154
6-mos forward	0.8865	0.8911	0.51	–0.6	1.1280	1.1223
China yuan	0.1628	0.1629	unch	1.4	6.1411	6.1389
Hong Kong dollar	0.1288	0.1288	unch	0.1	7.7624	7.7613
India rupee	0.01638	0.01640	0.11	–1.3	61.04995	60.97995
Indonesia rupiah	0.0000870	0.0000874	0.48	–5.5	11494	11439
Japan yen	0.00971	0.00968	–0.25	–2.2	103.01	103.28
1-mos forward	0.00971	0.00968	–0.25	–2.2	103.00	103.26
3-mos forward	0.00971	0.00969	–0.25	–2.2	102.97	103.23
6-mos forward	0.00972	0.00969	–0.25	–2.2	102.91	103.17
Malaysia ringgit	0.3035	0.3045	0.32	0.4	3.2945	3.2839
New Zealand dollar	0.8470	0.8472	unch	–2.9	1.1807	1.1804
Pakistan rupee	0.00991	0.00991	unch	–4.2	100.945	100.895
Philippines peso	0.0224	0.0224	0.08	0.4	44.585	44.551
Singapore dollar	0.7889	0.7882	–0.08	0.4	1.2676	1.2687
South Korea won	0.0009387	0.0009374	–0.14	0.9	1065.32	1066.80
Taiwan dollar	0.03300	0.03298	–0.06	1.2	30.301	30.319

TABLE 1.7 *continued*

	IN US$		US$ VS. % CHG		PER US$	
Country/currency	**Tues**	**Mon**	**1-Day**	**YTD**	**Tues**	**Mon**
Thailand baht	0.03089	0.03088	unch	–1.1	32.368	32.380
Vietnam dong	0.00005	0.00005	unch	–0.2	21089	21090
Europe						
Czech Rep. koruna	0.05066	0.05072	0.12	–0.8	19.739	19.716
Denmark krone	0.1857	0.1859	0.12	–0.8	5.3845	5.3779
Euro area euro	1.3860	1.3877	0.13	–0.8	0.7215	0.7206
Hungary forint	0.00441714	0.00444008	0.52	4.7	226.39	225.22
Norway krone	0.1678	0.1679	0.07	–1.8	5.9594	5.9551
Poland zloty	0.3281	0.3294	0.37	0.8	3.0476	3.0363
Romania leu	0.3077	0.3086	0.30	–0.1	3.2500	3.2402
Russia ruble	0.02743	0.02751	0.30	10.7	36.459	36.351
Sweden krona	0.1569	0.1570	unch	–1.0	6.3743	6.3711
Switzerland franc	1.1387	1.1393	0.05	–1.7	0.8782	0.8777
1-mos forward	1.1389	1.1396	0.06	–1.7	0.8780	0.8775
3-mos forward	1.1395	1.1401	0.06	–1.7	0.8776	0.8771
6-mos forward	1.1405	1.1411	0.05	–1.7	0.8768	0.8764
Turkey lira	0.4452	0.4508	1.26	4.5	2.2464	2.2185
UK pound	1.6617	1.6645	0.17	–0.4	0.6018	0.6008
1-mos forward	1.6613	1.6641	0.17	–0.4	0.6020	0.6009
3-mos forward	1.6605	1.6633	0.17	–0.4	0.6022	0.6012
6-mos forward	1.6593	1.6621	0.17	–0.4	0.6027	0.6016
Middle East/Africa						
Bahrain dinar	2.6528	2.6525	unch	unch	0.3770	0.3770
Egypt pound	0.1437	0.1437	unch	0.1	6.9613	6.9609
Israel shekel	0.2883	0.2878	–0.17	unch	3.4688	3.4747
Jordan dinar	1.4143	1.4139	unch	–0.1	0.7071	0.7073
Kenya shilling	0.01159	0.01155	–0.29	–0.2	86.297	86.547
Kuwait dinar	3.5530	3.5532	unch	–0.4	0.2815	0.2814
Lebanon pound	0.0006642	0.0006643	unch	unch	1505.50	1505.45
Saudi Arabia riyal	0.2667	0.2666	unch	unch	3.7502	3.7504
South Africa rand	0.0921	0.0931	1.05	3.5	10.8587	10.7455
UAE dirham	0.2723	0.2723	unch	unch	3.6729	3.6731

Source: Tullett Prebon, historical data prior to 12/09/14:ICAP plc; historical data prior to 6/9/11: Thomson Reuters. Available online at: http://online.wsj.com/mdc/public/page/2_3021-forex-20140311.html?mod=mdc_pastcalendar (last accessed May 27, 2015). Reprinted with permission of online.wsj 2014.

Concept Check 7

a. 100*US$1366.00=US$136,000.

Concept Check 9

There is no one answer to this question.

a. You don't know that troughs have bottomed out without being able to foresee the future.
b. You don't know that peaks have peaked out without being able to foresee the future.
c. The general answer is that you will see upward and downward movements in gold prices. However, this does not mean that you can accurately predict the *next* move—either whether it will be up or down or the duration of the movement (when it will reverse itself).

Concept Check 11

a. 12,500,000*US$.009715=$121,437.50