Table 11.1 Seasonality of CME Natural Gas Futures Prices on January 24, 2020

Maturity Month	Settlement Price
February 2020	1.926
March 2020	1.904
April 2020	1.940
May 2020	1.997
June 2020	2.078
July 2020	2.141
August 2020	2.170
September 2020	2.166
October 2020	2.199
November 2020	2.307
December 2020	2.501
January 2021	2.609
February 2021	2.576
March 2021	2.478
April 2021	2.255
May 2021	2.237
June 2021	2.271
July 2021	2.306
August 2021	2.310
September 2021	2.296
October 2021	2.320
November 2021	2.384
December 2021	2.553
January 2022	2.672
February 2022	2.636
March 2022	2.507
April 2022	2.259

Source: www.cmegroup.com

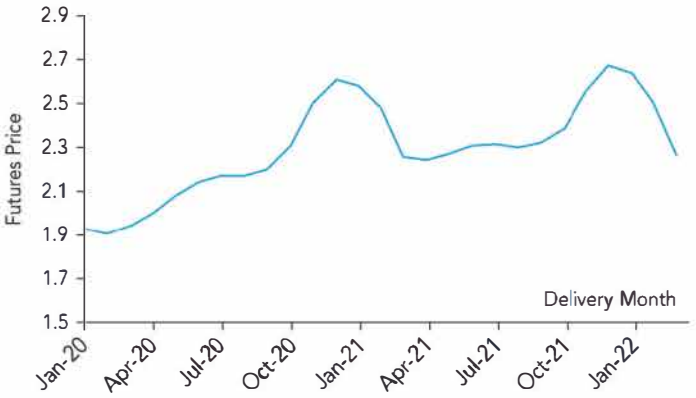

Figure 11.1 Plot of futures prices for natural gas from Table 11.1.

Weather

Derivative contracts on weather are available in both the exchange-traded and over-the-counter markets. The most popular contracts are those with payoffs contingent on temperature (which are used by energy companies as hedges).

Two important weather derivative variables are heating degree days (HDDs) and cooling degree days (CDDs). The HDD and CDD for a day are (respectively) defined as:

$$\text{HDD} = \max(0, 65 - A)$$

and

$$\text{CDD} = \max(0, A - 65)$$

where A is the average of the highest and lowest temperature during the day at a specified weather station (as measured in degrees Fahrenheit). For example, if the minimum temperature during a day (midnight to midnight) is 40 degrees Fahrenheit and the maximum is 60 degrees Fahrenheit, $A = (60 + 40)/2 = 50$. The daily CDD is therefore zero, and the daily HDD is 15. Contracts are usually defined in terms of the cumulative HDD and CDD for all the days in a given month.

11.3 COMMODITIES HELD FOR INVESTMENT

Some precious metals are held for investment purposes. Gold and silver (and to a lesser extent platinum and palladium) are in this category. While these metals have industrial applications, some purchasers hold these commodities purely for investment purposes. For these people, owning a futures or forward contract can be a practical substitute for owning the commodity itself.

The storage costs of the metals held for investment are generally low compared to metal prices and can therefore be ignored. Additionally, there is a generally small lease rate associated with metals held for investment. For example, gold is like a financial asset in that it can be lent from one entity to another to earn interest.

In analyzing the futures prices for investment commodities, we first ignore the lease rate. The commodities are then akin to financial assets providing no income and therefore Equation (10.1) of Chapter 10 should apply. This means that the relationship between the forward price and the spot price is

$$F = S(1 + R)^T$$