appendix 2 to chapter 5

Applying the Asset Market Approach to a Commodity Market: The Case of Gold

Both models of interest-rate determination in Chapter 4 make use of an asset market approach in which supply and demand are always considered in terms of stocks of assets (amounts at a given point in time). The asset market approach is useful in understanding not only why interest rates fluctuate but also how any asset's price is determined.

One asset that has fascinated people for thousands of years is gold. It has been a driving force in history: The conquest of the Americas by Europeans was to a great extent the result of the quest for gold, to cite just one example. The fascination with gold continues to the present day, and developments in the gold market are followed closely by financial analysts and the media. This appendix shows how the asset market approach can be applied to understanding the behavior of commodity markets, in particular the gold market. (The analysis in this appendix can also be used to understand behavior in many other asset markets.)

Supply and Demand in the Gold Market

The analysis of a commodity market, such as the gold market, proceeds in a similar fashion to the analysis of the bond market by examining the supply of and demand for the commodity. We again use our analysis of the determinants of asset demand to obtain a demand curve for gold, which shows the relationship between the quantity of gold demanded and the price when all other economic variables are held constant.

Demand Curve

To derive the relationship between the quantity of gold demanded and its price, we again recognize that an important determinant of the quantity demanded is its expected return:

$$R^e = \frac{P^e_{t+1} - P_t}{P_t} = g^e$$

where
R^e = expected return
P_t = price of gold today
P^e_{t+1} = expected price of gold next year
g^e = expected capital gain

In deriving the demand curve, we hold all other variables constant, particularly the expected price of gold next year P^e_{t+1}. With a given value of the expected price of gold next year P^e_{t+1}, a lower price of gold today P_t means that there will be a greater

appreciation in the price of gold over the coming year. The result is that a lower price of gold today implies a higher expected capital gain over the coming year and hence a higher expected return: $R^e = (P^e_{t+1} - P_t)/P_t$. Thus because the price of gold today (which for simplicity we will denote as P) is lower, the expected return on gold is higher, and the quantity demanded is higher. Consequently, the demand curve G^d_1 slopes downward in Figure 1.

Supply Curve

To derive the supply curve, expressing the relationship between the quantity supplied and the price, we again assume that all other economic variables are held constant. A higher price of gold will induce producers to mine for extra gold and also possibly induce governments to sell some of their gold stocks to the public, thus increasing the quantity supplied. Hence the supply curve G^s_1 in Figure 1 slopes upward. Notice that the supply curve in the figure is drawn to be very steep. The reason for this is that the actual amount of gold produced in any year is only a tiny fraction of the outstanding stock of gold that has been accumulated over hundreds of years. Thus the increase in the quantity of the gold supplied in response to a higher price is only a small fraction of the stock of gold, resulting in a very steep supply curve.

Market Equilibrium

Market equilibrium in the gold market occurs when the quantity of gold demanded equals the quantity of gold supplied:

$$G^d = G^s$$

With the initial demand and supply curves of G^d_1 and G^s_1, equilibrium occurs at point 1, where these curves intersect at a gold price of P_1. At a price above this

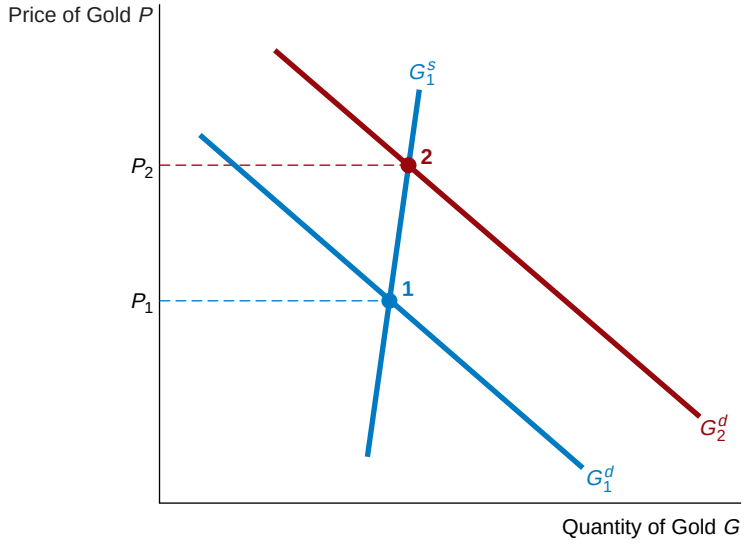

FIGURE 1 A Change in the Equilibrium Price of Gold

When the demand curve shifts rightward from G^d_1 to G^d_2—say, because expected inflation rises—equilibrium moves from point 1 to point 2, and the equilibrium price of gold rises from P_1 to P_2.

equilibrium, the amount of gold supplied exceeds the amount demanded, and this condition of excess supply leads to a decline in the gold price until it reaches P_1, the equilibrium price. Similarly, if the price is below P_1, there is excess demand for gold, which drives the price upward until it settles at the equilibrium price P_1.

Changes in the Equilibrium Price of Gold

Changes in the equilibrium price of gold occur when there is a shift in either the supply curve or the demand curve; that is, when the quantity demanded or supplied changes at each given price of gold in response to a change in some factor other than today's gold price.

Shift in the Demand Curve for Gold

Our analysis of the determinants of asset demand in the chapter provides the factors that shift the demand curve for gold: wealth, expected return on gold relative to alternative assets, riskiness of gold relative to alternative assets, and liquidity of gold relative to alternative assets. The analysis of how changes in each of these factors shift the demand curve for gold is the same as that found in the chapter.

When wealth rises, at a given price of gold, the quantity demanded increases, and the demand curve shifts to the right, as in Figure 1. When the expected return on gold relative to other assets rises—either because speculators think that the future price of gold will be higher or because the expected return on other assets declines—gold becomes more desirable; the quantity demanded therefore increases at any given price of gold, and the demand curve shifts to the right, as in Figure 1. When the relative riskiness of gold declines, either because gold prices become less volatile or because returns on other assets become more volatile, gold becomes more desirable, the quantity demanded at every given price rises, and the demand curve again shifts to the right. When the gold market becomes relatively more liquid and gold therefore becomes more desirable, the quantity demanded at any given price rises, and the demand curve also shifts to the right, as in Figure 1.

Shifts in the Supply Curve for Gold

The supply curve for gold shifts when there are changes in technology that make gold mining more efficient or when governments at any given price of gold decide to increase sales of their holdings of gold. In these cases, the quantity of gold supplied at any given price increases, and the supply curve shifts to the right.

Study Guide

To give yourself practice with supply and demand analysis in the gold market, see if you can analyze what happens to the price of gold for the following situations, remembering that all other things are held constant: 1) Interest rates rise, 2) the gold market becomes more liquid, 3) the volatility of gold prices increases, 4) the stock market is expected to turn bullish in the near future, 5) investors suddenly become fearful that there will be a collapse in real estate prices, and 6) Russia sells a lot of gold in the open market to raise hard currency to finance expenditures.

Application

Changes in the Equilibrium Price of Gold Due to a Rise in Expected Inflation

To illustrate how changes in the equilibrium price of gold occur when supply and demand curves shift, let's look at what happens when there is a change in expected inflation.

Suppose that expected inflation is 5% and the initial supply and demand curves are at G_1^s and G_1^d so that the equilibrium price of gold is at P_1 in Figure 1. If expected inflation now rises to 10%, prices of goods and commodities next year will be expected to be higher than they otherwise would have been, and the price of gold next year P_{t+1}^e will also be expected to be higher than otherwise. Now at any given price of gold today, gold is expected to have a greater rate of appreciation over the coming year and hence a higher expected capital gain and return. The greater expected return means that the quantity of gold demanded increases at any given price, thus shifting the demand curve from G_1^d to G_2^d. Equilibrium therefore moves from point 1 to point 2, and the price of gold rises from P_1 to P_2.

By using a supply and demand diagram like that in Figure 1, you should be able to see that if the expected rate of inflation falls, the price of gold today will also fall. We thus reach the following conclusion: ***The price of gold should be positively related to the expected inflation rate.***

Because the gold market responds immediately to any changes in expected inflation, it is considered a good barometer of the trend of inflation in the future. Indeed, Alan Greenspan, the chairman of the Board of Governors of the Federal Reserve System, at one point advocated using the price of gold as an indicator of inflationary pressures in the economy. Not surprisingly, then, the gold market is followed closely by financial analysts and monetary policymakers.