Money in an Interconnected World

In this chapter, after showing how interconnected the world is, I talk about the role that money plays in international trade. I talk about the determinants of trade patterns among countries and how exchange rates are determined. I show how actions of a foreign central bank affect the domestic economy, and vice versa. I end the chapter by talking about common currency areas and the European Monetary Union.

8.1 An Interconnected World

The world is interconnected. It has been for some time. We are all members of the same ancestral village in East Africa. Some of our ancestors left that village in search of greener pastures some 90,000 to 70,000 years ago, perhaps even earlier. According to a recent study, our human ancestors left Africa around 200,000 years ago and then some of them came back. Now, there are 53 ethnic groups as defined by the Human Genome Diversity Project spread across the globe, all members

1 Out of Africa. Quamrul Ashraf and Oded Galor. “The ‘Out of Africa’ Hypothesis, Human Genetic Diversity, and Comparative Economic Development.” The American Economic Review 103.1 (2013): 1–46. Print.

2 Human ancestors leaving Africa around 200,000 years ago. Lu Chen, et al. “Identifying and Interpreting Apparent Neanderthal Ancestry in African Individuals.” Cell 180 (2020): 1–11. Web.
of the same ancestral village in East Africa. Differences are deceptive. Evolution’s handy work at display.

It is not a stretch of imagination to say that the ones who moved out of their ancestral village stayed in touch with those who decided to stay put. They stayed in touch with each other at least for some time. They stayed in touch until close relatives and acquaintances died off and a newer set of close relatives and acquaintances took the place of the old ones. Some wandered to even distant places and physical distance between them and their kin became a barrier. Geological changes led to some routes being cut off and new ones being formed. The world is connected. While the nature of connections has changed, the connections have stayed intact.

Take the example of unemployment rates across four countries—the United States, Canada, the United Kingdom, and Australia. The United States and Canada share a border, the United Kingdom is separated by an ocean, and Australia is on the other side of the world, literally. Figure 8.1 plots data from the mid-1960s to the middle of the second decade of the twenty-first century.

While there are differences among the countries’ unemployment rates due to institutional differences—depth and width of social safety nets, for instance—the unemployment rates move together. See the increase in unemployment rate around 2008. That was the result of the 2007–2009 financial crisis and the Great Recession that spread across the world.

Another example of how we are all connected across the globe is through the spread of viruses. Be it Ebola, H1N1 flu virus, or the novel coronavirus (COVID-19). COVID-19, which started in Wuhan, Hubei Province, China, in late 2019, spread around the globe. The World Health Organization (WHO) declared it a “public health emergency of international concern” on January 30, 2020. By March, the COVID-19 had spread to 90 countries including the United States. On March 9,
2020, the World Health Organization announced that the COVID-19 epidemic was close to becoming a pandemic.\(^7\) China implemented a complete lockdown in the affected regions to control the virus. As the virus spread to Europe, Italy was the first European country to adopt the

\(^7\)WHO announcement. https://www.wsj.com/articles/confirmed-coronavirus-cases-outside-china-tripled-inpast-week-11583748569?mod=hp_lead_pos1 (Accessed: March 9, 2020).
measure. The Italian government banned public gatherings and all travel except for work or emergencies. All schools and universities were closed. By March 9, 2020, Italy had recorded over 9000 cases of infections and 463 deaths due to the COVID-19 coronavirus. Pictures of empty streets and airports started appearing in the news media. On March 11, 2020, as the number of infected individuals hit 121,564 and the number of dead reached over 4370 across 118 countries, the WHO declared COVID-19 a pandemic. “We’re deeply concerned, both by the alarming levels of spread and severity, and by the alarming levels of inaction. We have never before seen a pandemic sparked by a coronavirus,” the WHO Director-General, Tedros Adhanom Ghebreyesus, said in a statement. By May 26, 2020, COVID-19 had spread to 188 countries and regions, with 5,589,932 confirmed cases and 350,456 deaths worldwide, according to the Johns Hopkins University’s Coronavirus Resource Center. With new cases of infections and deaths being reported on an hourly basis if not sooner, the situation was evolving so rapidly that it was hard to keep up.

Sensing recession on the horizon due to decreased economic activity stock markets in the United States, the United Kingdom, Canada, Japan, France, Germany, and Australia, among other countries, plunged. In order to allay fears of the stock market participants, on March 3, 2020, the Federal Open Market Committee (FOMC) had an emergency meeting in between their regularly scheduled meetings. Later that day, the Federal Reserve Chair, Jerome H. Powell, announced in a press conference that the FOMC had decided to lower the target federal funds rate by 0.5 percent. This rather unusual action by the FOMC did not soothe the concerns of the stock market participants. According to the Wall Street Journal, for the year starting from January 2, 2020, by the closing time on March 9, 2020, various stock market indices were down by over 15 percent—United States (Dow Jones Industrial Average: −16.5 percent), United Kingdom (FTSE 100: −20.9 percent), Canada (S&P/TSX: −14.94 percent), Japan (Nikkei 225: −19.82 percent),

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8 Italy bans travel and public gatherings. https://www.nytimes.com/2020/03/09/world/coronavirus-news.html?action=click&module=Spotlight&pgtype=Homepage (Accessed: March 9, 2020).

9 COVID-19 declared a pandemic. https://www.wsj.com/articles/u-s-coronavirus-cases-top-1-000-11583917794?mod=hp_lead_pos1 (Accessed: March 11, 2020).

10 Spread of COVID-19 according to Johns Hopkins University. https://coronavirus.jhu.edu/map.html (Accessed: May 26, 2020).
France (CAC40: −21.25 percent), Germany (DAX: 19.84 percent), and Australia (S&P/ASX 200: −14.7 percent). By the close of the trading day on March 11, 2020, the losses had worsened. The headline on the Wall Street Journal’s Webpage read, “Dow Jones Industrial Average’s 11-Year Bull Run Ends.”\footnote{DOW ends its bull run. https://www.wsj.com/articles/global-markets-calmer-after-two-hectic-days-11583899913 (Accessed: March 11, 2020).} The index had dropped more than 20 percent from its February 12, 2020, peak. The Wall Street Journal’s Liz Hoffman in an article on Saturday, March 14, 2020, recalled the week from March 8, 2020, through March 13, 2020. The article’s title “Diary of a Crazy Week in the Markets” captures the essence well.\footnote{“Diary of a Crazy Week in the Markets.” https://www.wsj.com/articles/diary-of-a-crazy-week-in-the-markets-11584143715 (Accessed: March 15, 2020).}

We are all connected. No country is an island, not even an island.

\section*{8.2 Money and International Trade}

Subaru is a Japanese car company with plants in Japan, the United States, and Canada, among other countries. It produces a midsize sedan called Subaru Legacy. The window sticker on the car says that it was assembled in a Subaru plant in Lafayette, Indiana, from parts made in the United States and Canada (50 percent), and Japan (40 percent). According to Subaru’s Website, its main businesses are automotive and aerospace. It has over 15,274 employees as of March 31, 2019. Established in 1953, Subaru has a global footprint—Americas (18 countries), Asia (17 countries), Europe (35 countries), Middle East and Africa (13 countries), and Oceania (4 countries). As far as companies with international footprints are concerned, Subaru is a relatively small company. Even in the car manufacturing world, it’s not a large firm. It is not even among the top 20 car manufacturers in the world according to the International Organization of Motor Vehicle Manufacturers. In 2017, Subaru ranked 21st in the world as measured by the number of cars produced.\footnote{Rank of Subaru as a car manufacturer. http://www.oica.net/wp-content/uploads/World-Ranking-of-Manufacturers-1.pdf (Accessed: February 12, 2020).}

There are about 30,000 parts in a typical car with an internal combustion engine according to Toyota’s Website.\footnote{Number of parts in a car. https://www.toyota.co.jp/en/kids/faq/d/01/04/ (Accessed: February 12, 2020).}

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\end{itemize}
screw to a sophisticated computer that runs a complicated engine. Each of these parts has to be priced so that its value can be compared across parts and across manufacturers who often reside in different countries. We saw a glimpse of the detail with which various goods and services are categorized in Chapter 7.

According to the United Nations database, there are 193 member countries and two non-member countries (Holly Sea, also known as the Vatican City, and the State of Palestine) in the world as of this writing,\(^\text{15}\) and there are 164 currencies used in the world.\(^\text{16}\)

A trivia question: Just looking at the UN members, with which alphabet do the most country names start? Answer: Letter “S” is the most fecund; 25 country names start with the letter “S.” Letters “W” and “X” are issueless. Poor things.

When we include all the various countries and territories (UN members and non-members) with which the United States has trade relations, the number rises to 233, according to the United States Bureau of Census.\(^\text{17}\) In 2019, the total world trade—the sum of imports and exports of all countries—was $38,028,788 million US dollars. Out of that, according to the US Census Bureau, the total value of the US trade in goods and services in 2019 was $5,616,278 million US dollars. In case you are wondering, China is the biggest trading partner of the United States, as measured by trade value, followed by Mexico and Canada, respectively.

Imagine trading billions and billions of various goods and services with over 7.6 billion individuals\(^\text{18}\) spread across 233 countries and territories: a practical impossibility without a numeraire, i.e., money.

\(^{15}\) Number of countries in the world. https://www.un.org/en/member-states/index.html (Accessed: February 17, 2020).

\(^{16}\) Number of currencies used in the world. https://www.countries-oftheworld.com/ (Accessed: February 12, 2020).

\(^{17}\) Number of countries and territories with which the United States trades. https://www.census.gov/foreign-trade/Press-Release/2019pr/12/index.html. See also https://ec.europa.eu/info/european-union-and-united-kingdom-forging-new-partnership/eu-uk-withdrawal-agreement_en (Accessed: March 2, 2020).

\(^{18}\) World population. https://www.census.gov/ (Accessed: March 2, 2020).
8.3 The Determinants of Trade Patterns

What determines the volume of trade between two countries? One factor is an economy’s size as measured by its output. The larger an economy’s output, the larger its purchases and sales, including purchases from other countries (i.e., imports) and its sales to other countries (i.e., exports), holding everything else constant. Another factor that determines trade between two countries is the geographical distance. The farther apart the two countries are, the lower the volume of trade between the two countries. It makes sense. Holding all else constant, transportation costs increase with the increase in distance, which, in turn, raises the costs of goods and services. This model, called the Gravity Model in the economics literature, gives us a rough estimate.\(^\text{19}\) In Table 8.1, I provide trade in goods data, as a percentage of total US trade in goods, and GDP data, as a percentage of US GDP, for Canada, Mexico, Germany, Australia, and Ireland. (These data exclude trade in services.)

Looking at the data in Table 8.1, a few points stand out. One, even though the economies of Canada and Mexico, as measured by GDP as a percentage of the US GDP, are about the same size as Australia, their trade with the United States is a lot larger. Each country has about 15 percent of the US total trade in goods. Two, Germany has a lot larger economy as compared with Canada, Mexico, and Australia. Its share of trade in goods with the United States, however, is relatively small. Three, given the size of the Irish economy, its share of trade in goods with the United States is large. How do we explain these statistics?

The relatively low share of the US trade in goods with Australia may be explained by the physical distance between the two countries. As mentioned earlier, all else constant, the farther apart the two countries are, the higher the transportation costs, and the lower the volume of trade. Canada, Mexico, and the United States not only have common borders, they also have a free trade agreement—North American Free Trade Agreement (NAFTA).\(^\text{20}\) Singed in 1992, NAFTA took effect on

\(^{19}\)Gravity Model. *Gravity Equations: Workhorse, Toolkit, and Cookbook*, April 2013. [http://blogs.ubc.ca/khead/files/2016/07/headmayer_revised.pdf](http://blogs.ubc.ca/khead/files/2016/07/headmayer_revised.pdf) (Accessed: March 10, 2020). See also Michael E. Waugh. *International Trade and Income Differences*. 100 Vols., 2010. Web, Pauline Grosjean. *The Weight of History on European Cultural Integration: A Gravity Approach*. 101 Vols., 2011. Web.

\(^{20}\)NAFTA. [https://www.cbp.gov/trade/nafta](https://www.cbp.gov/trade/nafta) (Accessed: March 10, 2020).
Table 8.1  Trade and GDP percentages—Canada, Mexico, Germany, Australia, and Ireland

|        | [1] GDP as a percentage of US GDP | [2] Trade in goods as a percentage of total US trade in goods |
|--------|----------------------------------|---------------------------------------------------------------|
| Canada | 8.33                             | 14.78                                                         |
| Mexico | 5.93                             | 14.83                                                         |
| Germany| 19.18                            | 4.53                                                          |
| Australia | 6.97                        | 0.89                                                          |
| Ireland| 1.86                             | 1.71                                                          |

Source: Table prepared by the author. Note: Data are in current US dollars. Data Source: https://www.census.gov/foreign-trade/balance/index.html (Accessed: March 2, 2020)

January 1, 1994. Its expressed purpose is to gradually remove all trade barriers between the three countries.

If one were to fly from Washington, DC, to Berlin, Germany, depending upon the airline and stops along the way, it would take about 10 hours. It would take about the same flight time from Washington, DC, to Dublin, Ireland. Why does Ireland trade a lot with the United States given the size of the Irish economy? One reason is cultural ties.21 The United States has a large population of Irish descent. According to the 2000 United States Census data, there are 30,524,799 individuals of Irish ancestry in the United States. As is usually the case, immigrants bring with them their cultures and cultural ties, which help promote trade. Studies show that cultural familiarity promotes trust, one of the main currencies of any relationship, commercial or otherwise.22 Trust helps promote trade.

As a comparison, according to the 2000 Census data, there are 42,839,711 individuals of German descent, 14,443,629 are of Mexican descent, 4,890,581 are of Scottish descent, and 74,544 are of Australian descent. Given the high number of individuals of German ancestry, why does Germany not have closer trade ties with the United States? One reason may be the circumstances in which individuals of German descent

21 Cultural ties and trade. Paul R. Krugman, Maurice Obstfeld, and Marc J. Melitz. *International Economics: Theory and Policy*. 11th ed. New York, NY: Pearson, 2018. Print.
22 Familiarity and trust. Grosjean.
left Germany after the rise of Hitler. It is quite likely that those who left Germany for the United States did not have friendly ties with those who stayed even when they were in Germany. This is certainly true for at least a part of those who migrated to the United States from Germany. Who would want to maintain any relationship with one’s oppressor after having achieved freedom?

So geographic proximity, as espoused by the Gravity Model, does not provide an accurate estimate of trade patterns. It provides only a rough estimate. There are certainly other factors, including randomness, that affect trade patterns keeping trade economists busy. Further exploration of this topic, however, will take us too far afield.

Furthermore, it will be a mistake to think that just because a group of individuals happens to live in geographic proximity will have the same cultural mores. It may take hundreds of years for cultural integration to take place. Europe and the European Union provide vivid examples. Pauline Grosjean (2011) uses a modified Gravity Model to estimate social trust. She uses the historical divisions of 21 countries of the “central, eastern, and southeastern Europe” that belonged to “the Ottoman, Habsburg, Russian, or Prussian empires” (p. 504). Discussing her study’s empirical results, she writes:

Having belonged to the same former empire for more than 100 years has the consistent and robust effect of diminishing dissimilarities in social trust, even when physical distance between locations, sociodemographic, economic, and geopolitical conditions are taken into account. Such a persistent effect of past historical events, which are quite distant in time, is notable and sizeable and, strikingly, far outweighs the influence of current geopolitical factors, in particular nation states’ borders. (p. 506)

Trade agreements play a large role, and countries try very hard to form such agreements. Negotiations take years, if not decades. Even after that, all the hard work may not reach fruition. A recent example of such a failed effort is Trans-Pacific Partnership Agreement between Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, Vietnam, and the United States. After the Obama administration signed the agreement in February 2016, it was not ratified; the

23 History and social trust. Pauline Grosjean. The Weight of History on European Cultural Integration: A Gravity Approach. 101 Vols., 2011. Web.
Trump administration withdrew the US signature in January 2017.\textsuperscript{24} Even the agreements that have been ratified and have been successful for decades are not really safe. The United Kingdom had been a part of the European Union for nearly half a century. On January 31, 2020, the United Kingdom left the Union following a referendum in 2016 in which the British people voted to leave.\textsuperscript{25} The exit of the United Kingdom from the European Union, commonly known as “Brexit,” continues to be a topic of impassioned debate.

The point to be made here is that whatever the determinants of trade patterns, the fact remains that trade is mutually beneficial, and that money facilitates trade.

\section*{8.4 What Are Exchange Rates and Why Do We Need Them?}

Exchange rates are the prices of one currency in terms of other currencies. These prices are determined in the foreign exchange markets in major financial centers of the world (New York, London, Tokyo, Frankfurt, and Singapore) with forces of demand for and supply of a currency. For instance, on March 12, 2020, at 5:05 p.m., the price of one pound sterling, the currency used in the United Kingdom, in terms of US dollars was $1.2583. That is, for each pound sterling, one could get 1.2583 US dollars. Note that I am quoting the price of pounds sterling in US dollars by the minute. The purpose is not to sensationalize. The reason for providing the hour and the minute is that prices of currencies in terms of other currencies change very rapidly. Why does this happen? Why do prices change so rapidly? I will address this point shortly.

In Fig. 8.2, I plot daily data for the US dollar and pound sterling exchange rate from February 28, 2019, to February 28, 2020.

Note the fluctuations.

Why do we need to know about exchange rates? This is because for us to compare the value of two or more goods and services we have to evaluate these goods and services in the same unit. This is why we need

\textsuperscript{24} Trump administration withdraws from TPP. https://money.cnn.com/2017/01/23/news/economy/tpp-trump-china/ (Accessed: March 27, 2020).

\textsuperscript{25} UK leaves the EU. https://www.wsj.com/articles/brexit-brings-slow-change-in-uk-and-an-overhaul-in-brussels-11580399915?mod=article_inline. See also https://europa.eu/european-union/about-eu/easy-to-read_en (Accessed: March 27, 2020).
Fig. 8.2  US dollar and pound Sterling exchange rate (Source Figure prepared by the author. Data Source Board of Governors of the Federal Reserve System [US], US/UK Foreign Exchange Rate [DEXUSUK], retrieved from FRED, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/DEXUSUK [Accessed: March 15, 2020])

exchange rates. Take another look at Table 8.1. These data are reported in terms of US dollars. Had these figures been given in local currencies, one would first have to convert those figures into a common currency to be able to compare the values of goods and services. One would need exchange rates.

For the price of a good or service to exist, there has to be demand for and supply of the good or service. Currencies are no different. There has to be demand for and the supply of a given currency. From where do the demand for and the supply of a currency come? Take, again, the example of the price of the US dollar in terms of pound sterling—the US dollar and the pound sterling exchange rate. Why do the UK residents demand the US dollar and why do the US residents supply US dollars, and vice versa?

To keep things simple for now, assume that the source of demand by the UK residents is trade in goods and services. Same goes for the US residents. (There are other sources of demand for a currency, as we will
see later.) Suppose EasyJet, a British airline company, wants to purchase a Boeing 777-8 jet from Boeing, a US company that manufactures airplanes among other sophisticated machines. Its list price is 410.2 million US dollars.\footnote{List price of a Boeing 777-8. \url{https://www.boeing.com/commercial/777x/#/technical-specs} (Accessed: March 15, 2020).} Boeing accepts US dollars for its planes. EasyJet charges its customers in pounds sterling. EasyJet must convert pounds sterling into US dollars. EasyJet has created a demand for 410.2 million US dollars. When EasyJet wants to buy 410.2 million US dollars in exchange for $1.2583 per pound sterling, the exchange rate that prevailed on March 12, 2020, at 5:05 p.m., EasyJet has simultaneously created a supply of about 326 million pounds sterling.

From where does the supply of the US dollars come? Suppose that Bristol Myers Squibb, a biopharmaceutical firm headquartered in the United States with offices across the globe, buys iron, zinc, and platinum.\footnote{Three commonly used metals in medicine. \url{https://www.angloamerican.com/future-smart/our-industry/our-products/metals-in-medicine} (Accessed: March 16, 2020).} These are some of the metals used in modern medicines. AngloAmerican is a British mining company which sells these metals for £400 million to Bristol Myers Squibb.\footnote{AngloAmerican. \url{https://www.angloamerican.com/} (Accessed: March 16, 2020).} Bristol Myers Squibb is an American company and uses US dollars to buy and sell goods and services. AngloAmerican is a British company which buys and sells goods and services using pounds sterling. For the exchange to take place either Bristol Myers Squibb will have to convert US dollars into pounds sterling or AngloAmerican will have to accept US dollars equivalent to £400 million and then convert those dollars into pounds sterling.

Why can’t AngloAmerican just buy and sell goods and services using US dollars? The answer: AngloAmerican’s employees and suppliers who live in the United Kingdom only accept pounds sterling. Unless everyone in the United Kingdom starts accepting US dollars, at some point someone will have to convert US dollars into pounds sterling.

Suppose then that Bristol Myers Squibb converts US dollars into pounds sterling. At the exchange rate of $1.2583 per pound sterling, the exchange rate that prevailed on March 12, 2020, at 5:05 p.m., Bristol Myers Squibb buys 400 million pounds sterling for 503.32 million US dollars.
dollars. When Bristol Myers Squibb purchased 400 million pounds sterling for 503.32 million US dollars, it simultaneously created demand for £400 million and supply of $503.32 million.

In a similar fashion when someone from the US travels to the United Kingdom and they convert US dollars into pounds sterling, they supply US dollars and demand pounds sterling. And when someone from the United Kingdom travels to the United States and they convert pounds sterling into US dollars, they supply pounds sterling and demand US dollars.

Another example of the demand for and supply of a currency may be foreign students coming to the United States. Suppose that a Chinese student is admitted to a US university. Suppose also that annual room, board, tuition, and fees are $50,000. The Chinese student would have to convert Chinese Yuan into US dollars. On March 12, 2020, at 6:05 p.m., the price of each US dollar in terms of Chinese Yuan was 7.0296 Yuan. This means that 50,000 US dollars were worth 351,480 Chinese Yuan. This Chinese student created the demand for 50,000 US dollars and the supply of 351,480 Chinese Yuan.

As every student who has taken a principles-level economics course knows, when the price of a product increases, holding all else constant, its quantity demanded decreases, and when the price of a product decreases, its quantity demanded increases. This is the so-called law of demand. Let us revisit the example of EasyJet buying a Boeing 777-8. Suppose the exchange rate changes; the price of US dollars in terms of pounds sterling increases. Earlier each pound sterling could fetch 1.2583 US dollars, now each pound sterling is worth only 1.1 US dollars. That is, the US dollar appreciates (or strengthens) in terms of pound sterling. What does this imply for EasyJet? Assuming that price of a Boeing 777-8 stays the same in terms of US dollars ($410,200,000), in terms of pounds sterling the price has increased from £325,995,390.61 to £372,909,090.91. As a result, EasyJet buys fewer Boeing 777-8s.

What about Bristol Myers Squibb? How does this appreciation of the US dollar affect their purchase of iron, zinc, and platinum from AngloAmerican? Assuming that the price of iron, zinc, and platinum does not change in terms of pound sterling, after the appreciation of the US dollar, it has become cheaper for Bristol Myers Squibb to purchase the

[29] US dollar Yuan exchange rate. https://www.wsj.com/market-data/quotes/fx/USD_CNY?mod=md_curr_overview_quote (Accessed: March 18, 2020).
same amount of the three metals. It now only has to pay $440,000,000 as opposed to $503,320,000. Holding all else constant, it is likely that Bristol Myers Squibb will now purchase higher quantities of these metals. AngloAmerican’s sales to the United States will increase.

An appreciation of the US dollar makes imports cheaper for the domestic buyers and exports more expensive for the foreign buyers. As a result, an appreciation of a currency hurts exporters and helps importers, and a depreciation of a currency helps exporters and hurts importers.

**8.4.1 Spots, Forwards, Swaps, Futures, and Options**

As we saw, in our example, when the exchange rate was $1.1 per pound sterling and Bristol Myers Squibb needed £400 million to purchase iron, zinc, and platinum, the company needed $440 million. On the other hand, had the exchange rate been $1.2583 per pound sterling, Bristol Myers Squibb would have needed $503.32 million. Quite a bit of risk is associated with this transaction.

When someone buys a currency right when it is needed, the rate one pays is called spot rate—two parties agree to make the transaction (exchange bank deposits) “on-the-spot.” The data shown in Fig. 8.2 are spot exchange rate data. As we can see, there is quite a bit of fluctuation and hence risk associated with such transactions. Is there any way to avoid the uncertainty of exchange rate changes? The answer is “yes.” Financial markets offer several avenues of mitigating risks associated with exchange rate changes. These include currency forwards, currency swaps, currency futures, and currency options.

In a currency forward contract, two parties agree to exchange currencies at a given exchange rate at a particular date in the future. These dates may range from 30 days to several years in the future. In our example, suppose that Bristol Myers Squibb knew the date on which the said metals would be delivered. To avoid uncertainty, it could have agreed to purchase £400 million on the delivery date (or any other date in the future) at an agreed upon price. In this way, Bristol Myers Squibb would have had no concerns about fluctuations in the exchange rate and hence in the price of the metals. Roughly speaking, the forward exchange rate would be equal to the spot exchange rate expected to prevail when £400 million will be exchanged for US dollars.

In a currency swap, two parties agree to the sale of a currency now along with a repurchase agreement in the same amount at a future date.
“Why can’t someone in the US who needs, say pounds sterling, in the future sell US dollars now (in a spot market) and buy pounds sterling in a forwards market? Why have a different mechanism for this type of transaction?” you may ask. A reason may be that brokerage fees may be lower when you are making this one transaction as compared with two transactions, first to sell US dollars in the spot market and then to buy pounds sterling in currency forward market.

In a currency future, the buyer of the contract buys the right to purchase a given amount of foreign currency at a predetermined date in the future. The holder of the contract then can sell the contract—the right to purchase a given amount of foreign currency—in the futures market should they deem it a better choice as opposed to purchasing the currency at the said date. A currency future contract is different from a currency forward contract. In the latter case, the purchaser must fulfill their end of the deal.

Then, we have currency options. In a currency option, the purchaser of the contract can buy or sell the said amount of foreign currency at an agreed upon exchange rate any time up to the expiration date of the contract, and the seller of the contract must oblige. We can further divide currency option into “put option” and “call option.” In a put option, the buyer of the option has the right to sell foreign currency at an agreed upon exchange rate at any time up to the expiration date of the contract. A call option, on the other hand, gives the buyer of the option the right to purchase foreign currency at an agreed upon exchange rate any time up to the expiration of the contract date. Note that currency forwards, currency swaps, currency futures, and currency options are examples of financial derivatives. They are designed to hedge the risk in the foreign exchange market.

The curious reader may be wondering about the lack of detail provided in discussing the ways to hedge the exchange rate risks—currency forwards, currency swaps, currency futures, and currency options. I have avoided the details here because, in my opinion, these discussions, while certainly extremely valuable, will take too far afield from the topic at hand—the understanding of the concept of money. I refer the reader to the literature in the field.30

30 Studies on the various ways to hedge the exchange rate risk. Frank McCormick. Covered Interest Arbitrage: Unexploited Profits? Comment. 87 Vols., 1979. Web. See also Krugman, Obstfeld, and Melitz, Chapter 14.
8.4.2 *Foreign Currency as a Store of Value*

Buying and selling goods and services, of course, is not the only reason for the demand for and supply of foreign currencies. Individuals, firms (e.g., commercial banks, corporations, non-bank entities, etc.), and governments hold currencies as a store of value as well.

At this point, a reminder that money is something that serves as a medium of exchange, a unit of account, and a store of value, may be in order. Recall that as a store of value, money, as an asset, helps transfer purchasing power from present to the future. Recall also that currency is part of the M1 monetary aggregate. Since we are talking about currencies of different countries, I will focus on the currency component of M1.

8.4.2.1 *Liquidity*

Economic agents (individuals, firms, governments, etc.) hold currency as a store of value. But why currency? Why not a house or a piece of land or a piece of precious metal such as gold? Isn’t currency in danger of losing value in times of high inflation when price level is rising rapidly? True, if the rate of inflation is high, currency will lose its value rapidly. But currency, you may recall, is the most liquid asset. That is, it can be transferred into another asset the quickest. A house, on the other hand, may take some time to sell. And, depending upon the market conditions, if you want to sell a house quickly you may have to reduce the price significantly. Liquidity is a desirable quality in an asset. Holding all else constant, economic agents may keep currency as an asset because it is the most liquid asset.

8.4.2.2 *The Expected Rate of Return*

Savers look for the rate of return. As we saw in earlier chapters when one rents a house or an apartment, the owner of the dwelling charges rent. In the same fashion when someone borrows, one is renting purchasing power, and the lender charges interest. In the case of money, interest is the counterpart of rent of a dwelling. Interest rate is just the interest payment as a percentage of the principal. Holding all else constant, the higher the interest rate a borrower is paying, the more attractive the opportunity it is for the lender.

When it comes to holding foreign currency as a store of value, the picture is a bit more complicated. Take the example of holding US dollars versus pounds sterling as a store of value. Simply comparing interest rates
on pound sterling deposits with the interest rates on US dollar deposits will not do. We have to get the exchange rate. Including exchange rate between US dollar and pound sterling into the equation will give us a better understanding. It will give us total rate of return on US dollar deposits versus the total rate of return on pound sterling deposits.

Suppose that you want to compare the US dollar rate of return on pound sterling deposits with the rate of return on US dollar deposits. We have to convert pounds sterling and the US dollars into the same measure—either pounds sterling into US dollars or the US dollars into pounds sterling—so that they can be compared. Since, in this example, we want the US dollar rate of return, we need to convert pounds sterling into US dollars. Holding the interest rates offered on both currency deposits constant, if one currency’s price in terms of the other currency is expected to change, it will certainly affect the rate of return.

The example of Celsius and Fahrenheit may be helpful. While both Celsius and Fahrenheit are measures of temperature, a zero degree Celsius is not the same as zero degree Fahrenheit. A given value represents different temperatures under Celsius versus Fahrenheit. (Except, of course at −40 degrees: −40 degrees Celsius is equal to −40 degrees Fahrenheit.) And a one degree increase in Celsius is not the same as a one degree increase in Fahrenheit. In essence, converting one currency into another currency is no different than converting Celsius into Fahrenheit or Fahrenheit into Celsius so the change in temperature can be measured.

Let us continue the example of comparing the rate of return on US dollar deposits with the rate of return on pound sterling deposits. Suppose that the US dollar is expected to depreciate against the pound sterling. That is, the price of a pound sterling in terms of US dollars is expected to increase. A simple rule, which takes the exchange rate changes into consideration, is as follows: The US dollar rate of return on pound sterling deposits, in US dollar terms, is approximately equal to pound sterling interest rate plus the expected US dollar rate of depreciation against pound sterling.\footnote{Simple rule for calculating one currency’s rate of return on deposits in another currency. Paul R. Krugman, Maurice Obstfeld, and Marc J. Melitz. \textit{International Economics: Theory and Policy}. 11th ed. New York, NY: Pearson, 2018. Print.}

Why do we add the US dollar rate of depreciation to the pound sterling interest rate on deposits? We do this to capture the changes in exchange rate. We want to look at the rate of return on pound sterling deposits
in terms of the US dollars. If the US dollar rate of depreciation against pound sterling is high, the US dollar rate of return on pound sterling deposits, in terms of US dollars, will be high. The reverse will be the case if the expected US dollar rate of depreciation is low. Keep also in mind that we are talking about real rates of return, not nominal rates of return. That is, rates of return after having the effects of changes in price levels taken out.

By way of summing up, we can say that the demand for a currency is positively related to the expected rate of return, positively related to its liquidity, and negatively related to its riskiness, all else equal. I must mention here that when it comes to the demand for a currency, economists primarily focus on the expected rate of return of the currency relative to the expected rates of return of other currencies.

### 8.4.3 The Exchange Rate Equilibrium

(Readers who are not interested in the underlying details of the exchange rate equilibrium mechanism may skip this subsection.)

As you may have guessed, an equilibrium in the foreign exchange market takes place when the quantity demanded of a currency is equal to the quantity supplied of a currency. At this point, the expected rates of return on both domestic and foreign currencies, when measured in the same currency, are the same. This condition is referred to as the Interest Parity Condition.

Figure 8.3 and Eq. 8.1, which are based on the framework presented in Krugman et al. (2018), provide a detailed explanation of the exchange rate equilibrium.

We may write the expression $r^e_£$ as follows:

$$r^e_£ = r_£ + \left(\frac{\$}{£}\right)^e - \left(\frac{\$}{£}\right)$$

where, as defined above, $r^e_£$ is the expected real rate of return, in terms of US dollars, on pound sterling deposits; $r_£$ is the real interest rate on

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32 Source of the framework in Fig. 8.3. Paul R. Krugman, Maurice Obstfeld, and Marc J. Melitz. *International Economics: Theory and Policy.* 11th ed. New York, NY: Pearson, 2018. Print, Chapter 14.
Fig. 8.3 Equilibrium in the exchange rate market (Source: Figure prepared by the author. $/£ is the US dollar-pound sterling exchange rate. \( \$r_e^\£ \) is the expected real rate of return on pound sterling deposits in US dollars. The curve \( r_e^\£ \) is the real expected rate of return on US dollar deposits which is vertical at \( r_S \), the real rate of return on US dollar deposits, set by the Fed)

pound sterling deposits; and \( \frac{(\frac{\$}{\£})^e - (\frac{\$}{\£})}{(\frac{\$}{\£})} \) is the expected rate of depreciation of the US dollar against pound sterling.

Why does the expected real rate of return on pound sterling deposits in US dollars curve slope downward? Suppose that the quantity \( (\frac{\$}{\£}) \) increases. That is, the price of a pound sterling in terms of US dollars increases—US dollar depreciates against pound sterling now. Given the real interest rate on pound sterling deposits, \( r_\£ \), and the expected price of a pound sterling in terms of US dollars, \( (\frac{\$}{\£})^e \), i.e., expected exchange rate, say, a year from now, when the quantity \( (\frac{\$}{\£}) \) increases now, the quantity \( \frac{(\frac{\$}{\£})^e - (\frac{\$}{\£})}{(\frac{\$}{\£})} \) decreases. This means that the expected real rate of return on pound sterling deposits in US dollars, \( \$r_e^\£ \), decreases. In terms of Eq. 8.1, we are adding a smaller quantity to \( r_\£ \) after the depreciation of the US dollar against pound sterling.
Why is the expected real rate of return on US dollar deposits, \( r_s^e \), is vertical at \( r_s \)? Recall from Chapter 5 that the Fed sets the target for the federal funds rate—the interest rate that banks charge each other for overnight loans. The Fed then changes money supply such that the target is met. Furthermore, while there are differences between the various interest rates that prevail in an economy at any given time, they tend to move together. And while the federal funds rate is in nominal terms, real interest rate moves accordingly for given inflation rate. As we saw in Chapter 7, when we want to convert a nominal variable into a real variable, we take the effects of prices out. Using the same underlying reasoning, one may get real interest rate, \( r \), by deducting inflation rate, \( \pi \),—the percentage increase in price level—from the nominal interest rate, \( i \). Real interest rate may be expressed as follows:

\[
 r = i - \pi \tag{8.2}
\]

In Eq. (8.2), \( \pi \) represents inflation rate.

How do we arrive at \( ($/£)^* \), the equilibrium exchange rate? Suppose now that the exchange rate is above \( ($/£)^* \). The rate of return on US dollar deposits is higher than the expected real rate of return on pound sterling deposits, in terms of US dollars. Savers will convert pounds sterling into US dollars. As a result, price of the US dollar in terms of pound sterling will increase—the US dollar will appreciate—leading to a decline in the quantity \( ($/£) \). The reverse will happen when the exchange rate is below \( ($/£)^* \).

### 8.5 The Effects of the Foreign Central Bank Action on the Domestic Economy

We saw in Chapter 5 that a central bank may change money supply to affect interest rates in the economy. Take, again, the example of the central bank of the United States, the Federal Reserve System, or the Fed, for short. When the Fed wants to decrease interest rates in the economy, it lowers the target of the federal funds rate. The Fed then decreases money supply, using the monetary policy tools at its disposal (Chapter 5, Sect. 5.3.1), such that the target is met. Since various interest rates that prevail in the economy move together, these interest rates also decrease. A decrease in interest rates makes borrowing cheaper which leads firms to borrow more and build more factories or expand the existing ones, and
so on. A lowered interest rate also makes borrowing cheaper for households as well, which affords them to build new houses or add a room or two, or buy big-ticket items like cars and appliances. The demand for these items increases. Firms increase production to meet the demand. As a result, output increases. The reverse happens when the Fed increases interest rates.

Do the actions of a central bank affect other economies as well? A short answer is “yes.” Let me go into a bit more detail.

### 8.5.1 Changes in Money Supply, Interest Rates, and Exchange Rates

Recall, again, that a change in the federal funds rate triggers changes in other interest rates that prevail in the economy, including interest rate on US dollar deposits and other financial assets. One can modify Fig. 5.6, which shows money demand, $M_d$, money supply, $M_s$, and interest rate, $i$, in nominal terms, to show money demand, money supply, and interest rate in real terms. Recall, again, that in order to convert nominal variables into real variables one has to take the effect of prices out. We have already seen how to convert nominal interest rate into real interest rate using Eq. (8.2). We can convert nominal money demand, $M_d$, and nominal money supply, $M_s$, by dividing both variables by price level, $P$, $\frac{M_d}{P}$ and $\frac{M_s}{P}$, respectively. Figure 8.4 shows this modified version. Figure 8.4 also shows how a decrease in real money supply, where price level is held constant, will affect the real interest rate.

Suppose that the Fed increases the federal funds rate target and decreases money supply in order to meet the new target. In terms of Fig. 8.4, with a given price level, real money supply curve, $\frac{M^1_s}{P}$, shifts to the left to $\frac{M^2_s}{P}$. This, in turn, leads to an increase in equilibrium real interest rate from $r^*_1$ to $r^*_2$.

Link this chain of events to Fig. 8.3 to see how this action by the Fed will affect US dollar and pound sterling exchange rate. In terms of Fig. 8.3, the curve $r^*_E$, which represents the expected real rate of return on US dollar deposits, shifts to the right. Since now the expected real rate of return on US dollar deposits is higher than the expected real rate of return on pound sterling deposits, in terms of US dollars, savers exchange their pounds sterling for US dollars. The US dollar exchange rate against
pound sterling improves—the price of US dollars in terms of pounds sterling increases. In terms of Fig. 8.3, the quantity \($\frac{\text{£}}{\text{£}}\) decreases. Now a given number of pounds sterling can purchase fewer US dollars.

### 8.5.2 Changes in Money Supply, Price Level, and Exchange Rates

In the previous subsection, we held the price level constant. This assumption is closer to reality in the short run, but not in the long run. Note that short run, as economists define it, is a situation where at least one cost of production—wages, prices of raw materials, rents, etc.—is fixed. In the long run, on the other hand, all costs of production are variable. Prices of inputs are able to adjust. This means that the impact of money supply changes in the short run may be different from that in the long run.

While some input prices adjust on a daily basis, most input prices are set for a significant amount of time throughout the year. Examples of prices that change daily, if not hourly, include prices of crude oil, gas, various metals, exchange rates, etc. Indeed, as we saw earlier in this chapter, exchange rates are reported on a minute-by-minute basis. On
the other hand, take the example of wages of labor, the major cost of production in most manufacturing jobs. Usually, salaried workers get the same pay throughout the year, and salary changes, if any, are made on an annual basis. Similarly, suppliers of raw materials and intermediate goods prefer not to change prices that often. One important reason is that renegotiating contracts is costly. It would not be optimal for suppliers to renegotiate contracts as long as the marginal cost of renegotiation is higher than the marginal benefit. This means that prices are relatively stable.

Suppose now that the Fed increases money supply to spur aggregate demand. Producers increase output to meet the increased demand. Demand for raw materials increases and workers are asked to work longer hours. Employers will have to pay overtime even if there is not any renegotiation of contracts right away. Over the course of the year, however, when contracts become due, workers demand higher wages and salaries, and raw materials and intermediate goods suppliers demand higher prices. The overall price level increases, so does the price of foreign currency in terms of domestic currency, i.e., the exchange rate. After all, exchange rate is the price of foreign currency in terms of domestic currency. The country whose money supply increases has a depreciated currency, and the country whose money supply decreases sees an appreciation in its currency, all else constant. A takeaway is that in the long run, changes in price level and exchange rate are proportionate to the changes in money supply.

8.6 Common Currency Areas

Robert Mundell wrote the following in an article:

Two thousand years ago, in the days of Caesar Augustus, there was the Roman aureus. A thousand years ago, there was a successor of the aureus, the bezant, which was still a unit of account through most of Europe. Five aurei or bezants were always equal to one libra, the unit of account of the Roman Empire, and that was the link through the ages to the currency of

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33 Share of labor wages in cost of production. Michael D. Giandrea and Shawn A. Sprague. “Estimating the U.S. Labor Share.” *Monthly Labor Review* (2017): A1. ProQuest Business Collection (Alumni Edition). Web.

34 Historical records of single currency. Robert Mundell. “The Case for a World Currency.” *Journal of Policy Modeling* 34.4 (2012): 568–78. Web.
Charlemagne to those of Queen Victoria. A hundred years ago, the pound sterling could pass for a universal unit of account. Even as recently as forty years ago, there was the “1944 gold dollar” that was the universal unit of account for most of the world. (p. 569)

In fact, in the initial plans of Bretton Woods Agreement, there was a suggestion of having a world currency. “The American Plan named it unitas; the British plan named it bancor” (p. 571, italics original), Mundell continues.

One can avoid all the complications that arise from having different currencies. There would not be any issues involving exchange rates if there were only one currency. After all, in the United States, we do not have any exchange rate issues: There are 50 states and all use the same US dollar. There have been concerted efforts to do just that starting in the second-half of the twentieth century.

Centuries of wars among various European countries and city-states had cost countless lives and immeasurable treasure. European intellectuals and politicians alike had been thinking about formulating a cohesive union to avoid a repeat ever since the end of World War II. In 1951, Belgium, Germany, France, Italy, Luxembourg, and the Netherlands decided to cooperate economically. At the end of 2018, there were 28 members of the European Union (EU) with a combined GDP of $18.8 trillion (current US dollars), rivaling that of the United State—$20.6 trillion (current US dollars). At the time of this writing, after the United Kingdom had decided to leave the EU, there are now 27 countries that are members of this Union. In January 1999, 11 member countries of the EU joined the European Monetary Union (EMU), and by 2002 fully adopted a single currency, the euro. The United Kingdom and Denmark did not adopt the euro. Over time, the number of countries that adopted the euro grew. There are now 19 member countries that use the euro.36

35 GDP of EU at the end of 2018. World Bank, Gross Domestic Product for the European Union [NYGDPMKTPCDEEU], retrieved from FRED, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/NYGDPMKTPCDEEU (Accessed: March 28, 2020).
36 The European Union member countries and the euro. https://europa.eu/european-union/about-eu_en (Accessed: March 28, 2020).
While the estimates may differ, economists agree that the benefits of having a single currency are numerous.\textsuperscript{37} For starters, information and transaction cost associated with converting one currency into another go away. For instance, the European Commission estimated that the gains from carrying out transactions in a single currency could be as high as 0.5 percent of the EU GDP per year.\textsuperscript{38}

There are, however, four conditions that have to be met for these benefits to arise. As Michael Kouparitsas (1999) put it:

1) countries should be exposed to similar sources of disturbances (common shocks); 2) the relative importance of these common shocks should be similar (symmetric shocks); 3) countries should have similar responses to common shocks (symmetric responses); 4) if countries are affected by country-specific sources of disturbances (idiosyncratic shocks), they need to be able to adjust quickly. (p. 2)

The reason is that when countries join a single currency they give up their freedom to conduct monetary policy. When the economic shocks are asymmetric, this inflexibility may lead to low economic growth rates and high unemployment rates.

In an empirical analysis to test the long-term viability of EMU, Kouparitsas (1999) combined countries on the basis of similarity of disturbances and responses to these disturbances. He considered Austria, Belgium and Luxembourg (treated as one country due to data limitations), France, Italy, the Netherlands, Portugal, and Spain as the “center,” while Finland and Ireland as the “periphery.” The results of this study led Kouparitsas to conclude that “the EMU will be a viable currency union for the center countries” (p. 3). Based on the results of his study, he questioned the long-run viability of countries in the periphery.

The 2007–2009 financial crisis and the following Great Recession that engulfed the developed world presented another test of the feasibility of the euro. While the euro survived, there was unnecessary hardship

\textsuperscript{37} Benefits of single currency. Robert A. Mundell. “Currency Areas, Common Currencies, and EMU.” American Economic Review 87.2 (1997): 214–16. Web, Mundell: 568–78.

\textsuperscript{38} Gains from carrying out transactions in a single currency. Michael A. Kouparitsas. “Is the EMU a Viable Common Currency Area? A VAR Analysis of Regional Business Cycles.” Federal Reserve Bank of Chicago Economic Perspectives 23.4 (1999): 2–20. Web.
imposed on countries like Greece, Ireland, and Spain. As the Great Recession hit and output declined, tax revenues in these countries declined as well. As a result, these countries’ debt-to-GDP ratios soared. To meet the mandates of the EMU regarding budget deficit limits, member countries adopted austerity measures. Governments decreased their expenditure and raised taxes. Not surprisingly, this fiscal contraction further decreased output and increased unemployment. A downward spiral began leading to even lower government revenues and higher deficits as a percentage of GDP. Spain, for instance, had a budget surplus on the eve of the Great Recession. Spain’s surplus in 2007 was 20,739 million euros. Soon after this budget, surplus turned into budget deficit. By 2009, Spain’s deficit reached 116,429 million euros. (Data in current euros.)

What can make a single currency work? An oft-used apt analogy is that of a three-legged stool. Economic theory and empirical evidence suggest that for a single currency to function properly, having monetary union is not enough. Along with monetary union, we have to have a political union and a fiscal union. If either of them is missing the other two will not work either; the stool will not be a stool.

Optimists, however, remain undeterred. Robert Mundell (2012) suggested going even further. He suggested creating a world currency that would combine “dollar–euro–yen or dollar–euro–yuan” and called it “DEY.”

The next chapter, Chapter 9, provides some concluding remarks. I present some questions that have not yet been answered in the literature.

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