3.1 Global Market’s Ecosystem

Institutional investors’ behavior is bound by rules and constraints; knowing and understanding them is essential in the Global Market business. For example, a money market fund will only buy money market instruments and trying to sell them stocks is a waste of everyone’s time. Or a particular mutual fund may have a weekly internal meeting during which portfolio reallocations are being coordinated, and knowing the precise timing of the decision-making process is valuable knowledge to any salesperson covering this client. Successful sales, trading and research employees are able to “put on the hat” of each of their clients and are able to anticipate their very next move. One of the biggest compliments you can get from your client, after proposing an idea or sharing an observation, is that this is something they just now planned on focusing on next and that your input is timely and relevant.

3.1.1 Buy-Side vs. Sell-Side

The *buy-side* refers to market participants that put capital at work, often on behalf of their own end-customers. This typically involves purchasing securities, although part of the management of portfolios may also involve the occasional selling of securities. The *sell-side* consists of firms that issue, sell or trade securities. Examples for buy-side firms are investment managers,
pension funds and hedge funds; examples for sell-side firms are investment banks, broker-dealers\textsuperscript{1} and advisory firms.\textsuperscript{2}

Although the buy-side and the sell-side work very closely with each other on a daily basis, there is no denying that there are often conflicts of interest.\textsuperscript{3} The agent acting on behalf of the buy-side firm, say a portfolio manager of a mutual fund, is tasked to make investment decisions that generate the best risk-adjusted return on capital within the specific portfolio management mandate. The agent acting on behalf of the sell-side firm, say a broker-dealer, is expected to \textit{monetize} the client relationship in such a way that the benefits of the sell-side firm is maximized in the long run. This may include earning high fees and trading commissions, or to gain insight into the trading flows of the buy-side that, in turn, helps their own trading desk to enter into profitable trading positions. If, for example, the agent of the buy-side and the agent of the sell-side are discussing a potential trade that generates a high commission income for the sell-side firm, but creates an inappropriately high-risk position to the buy-side firm, the agent of the sell-side firm may feel compelled to “push” the trade anyway. Proclaiming “this is not a good trade for you” does not get the sell-side agent paid, although it may help develop a more trusting long-term relationship that creates a more profitable relationship in the long run.

Many agents of the buy-side have started their career on the sell-side. The buy-side likes hiring from the sell-side because those hires not only bring valuable product and market knowledge but are also less susceptible to potential sell-side pressure. More than once a client (from the buy-side) had told me that he or she was in my position some years back, which felt like receiving a friendly warning not to try some sell-side “tricks.”

The role of buy-side agents extends beyond “just” executing trades. A buy-side agent is often required to perform in-house research, present views on markets, products and investment opportunities within his or her organization or its clients, perform financial modeling and valuation, or to grow AUM. From a sell-side agent it is de facto required to assist the buy-side counterparts as much as possible in those tasks, even though this does not immediately lead to trading revenues. Smart buy-side agents will try to offload as much of their daily workload to the sell-side as a prerequisite for “doing business” with them.

It is often debated whether it is more advantageous to work on the buy-side or on the sell-side. The benefit of being on the sell-side is that one has little, or no, responsibility for the performance of the financial market instruments sold to the buy-side. Buy-side agents, on the other hand, are typically measured against the risk-adjusted returns resulting from their
investment decisions. For example, many sell-side employees that were, at least in part, responsible for the dissemination of US mortgage products that ultimately created tremendous losses to the buyers were able to hold on to their job, while many of their buy-side counterparts got laid off in the wake of the mortgage market crisis. In fact, the career on the buy-side, e.g., as a trader for a hedge fund, can be rather short (only a few years, although remuneration is typically attractive during that period), while there are many employees working on the sell-side for ten to twenty years, or even longer than that.

One (perceived) advantage of being on the buy-side is to be in the stronger position during a buy-side-sell-side negotiation. As a customer, the buy-side agent can expect to be treated with courtesy and respect, while the sell-side agent is often beaten up and abused by demanding and, at times, rude buy-side representatives. An illustrative way in which to dramatize the difference between being on the buy-side and on the sell-side is captured in the following adage:

On the buy-side, you say, “F*** you!” and hang up the phone.
On the sell-side, you hang up the phone and only then say, “F*** you!”

### 3.1.2 Banks

Banks are *depository institutions* that have a *banking license* required to accept deposits from retail customers. The original business model of banks is often jokingly portrayed in the following way:

> “Once upon a time, there were bankers whose lives were marked by three numbers.
> Do you know those numbers?
> They were 3, 6 and 3.
> Bankers paid 3% interest on deposits,
> earned 6% on loans,
> and at 3 in the afternoon they drove to the golf course.”

Following the banking crisis of 2008 and with more FinTechs offering bank-like services, banks are no longer trusted to be the sole providers of banking services. With or without banks, banking remains necessary. For now, most banking services are still provided by classical banks. Typically, a banking license is required to provide certain banking services.
intents and purposes, a provider of banking services has to either become a
bank or partner up with a bank.

Banks play two major roles in the financial markets. First, they act as
advisers, earning fee income for businesses such as mergers and acquisition
services. Second, they act as intermediaries between lenders/savers and bor-
rowers/spenders, typically earning a spread. For the latter, they use their bal-
ance sheet to conduct what is called financial transformation. An example
for financial transformation would be to accept short-term consumer depos-
its and to use that money to give a construction loan. The deposit would go
onto the liability side of the bank’s balance sheet, while the loan makes it
onto the asset side. Thus, financial transformation increases a bank’s balance
sheet. Providing balance sheet, however, is expensive because for regulatory
reasons a part needs to be covered by equity, thus requiring the genera-
tion of a proper return on equity (RoE) or return on risk-adjusted capital
(RORAC).

Financial transformation, capitalizing on mismatches between the asset
and liability side of a bank’s balance sheet, can take several forms. The most
important ones are size transformation, maturity transformation, credit trans-
formation, liquidity transformation and risk transformation.

Size Transformation makes the size of assets and liabilities most appeal-
ing to supply and demand in the financial markets. Banks typically cover
both, small-size and large-scale market participants and bundle/split oth-
wise offsetting financial flows to fulfill the need for a particular size. See
upper-left box in Fig. 3.1. Maturity transformation is the business model
of borrowing money on shorter time frames and to lend it out for a longer
time. If the yield curve is upward-sloped, this results in a positive margin.
See lower-left box in Fig. 3.1. Credit transformation is the process of enhanc-
ing credit quality (often by means of securitization). This is done by pooling
assets, and then tranching them into separate sets of claims with different
priorities. Due to institutional supply-demand imbalances, credit transfor-
mation allows higher-yielding credit pools to be financed at a lower average
yield. See upper-right box in Fig. 3.1. Liquidity transformation is the fund-
ing of illiquid assets with liquid liabilities. Because illiquid assets command
a liquidity premium, liquidity transformation results in a yield pickup. See
lower-right box in Fig. 3.1. Finally, risk transformation is the process of mit-
gating risks by applying risk-reduction techniques such as diversification,
pooling, screening and monitoring of assets, or formation of reserves.

For the Global Markets area of a universal bank, other banks can be cli-
ents or competitors. If another bank requests a quote on, say, an interest rate
swap, this could be to take advantage of a mispricing of your own trading
3 Fundamentals of the Banking Business

...desk (i.e., acting as a competitor), or to reduce the maturity gap on their balance sheet (i.e., acting as a client of yours).

3.1.3 Shadow Banks

Shadow banks are market participants providing banking services outside the scope of regulatory supervision. They include hedge funds, insurance companies, pension funds and money market funds. Because they don’t have a banking license that is required to accept retail deposits they are also called nondepository institutions. Lacking the ability to fund themselves through deposits, shadow banks tend to use wholesale funding, including repo (see Fig. 3.2).

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**Fig. 3.1** Size, maturity, credit and liquidity transformation

**Fig. 3.2** Depository vs. nondepository institutions
Like “regular” banks, shadow banks also engage in financial transformation. Without, or with less, government regulation, shadow banks typically hold less equity and reserves, and may use more leverage.

Shadow banks and regular banks are not always in a competitive relationship. For example, hedge funds and banks increasingly team up for asset-backed lending. They slice the securitized loan into different tranches, with banks taking the senior (less-risky) tranche, and hedge funds taking the junior tranche (also called equity tranche) and the mezzanine tranche (the tranche between the senior and the junior tranche). This is done either by the hedge funds making the whole loan and in turn financing it with a bank lending line, or banks advance two loans simultaneously (in a so-called A/B structure) and then only keep the lower risk part.

According to the Financial Stability Board, shadow banks are controlling roughly half of all global financial assets and their share keeps increasing.8

3.1.4 Exchanges

Exchanges are physical or virtual locations where buyers and sellers (or their agents) meet at to trade standardized products (fungible goods) according to set rules. Nowadays, most financial market exchanges allow for electronic order submissions (as opposed to floor trading) where orders are matched according to algorisms on the exchange’s computer server. Thus, they are virtual locations, similarly to ebay.

Exchanges compete with each other in the sense that they try to become the most liquid market, attracting most of the order flow. From a global market participant’s perspective, selecting the most appropriate exchange place is a crucial part of the trade execution decision-making process. A hedge fund engaged in high-frequency trading and statistical arbitrage trading may have completely different preferences than, say, a mutual fund executing a large block of securities.

Exchanges differentiate themselves from each other is by having differing trading models. They include:

- Quote-driven markets, where some (dedicated) participants stand ready to transact at given prices;
- Order-driven markets, where buy and sell orders are collected and matched in auctions;
- Hybrid markets with combinations thereof.
3.1.5 Pension Funds

Pension funds collect, pool and invest funds contributed by sponsors (employers) and beneficiaries (employees and their family members) to provide for the future pension entitlements of beneficiaries. Pension funds are, after mutual funds, the most dominating private investors with some $28 trillion in aggregated assets under management in the OECD area. More than 90% of that coming from just seven countries, with the lion share of almost 60% coming from the USA alone. This means that if you end up covering pension funds as your client base, they most likely consist of mostly US and UK pension funds. For example, Swedish pension funds have less than 0.2% in assets under management than the USA.

Pension funds operate with different business models:

- Pay-as-you-go;
- Defined benefit;
- Defined contribution;
- Hybrid types.

The business model is important because it dictates to a large degree the pension funds’ market behavior. A defined-benefit model guarantees future pensioners a certain pension. In order to grow contributions to that target amount, a specific return on investment is needed. That target return can be higher than what low-risk investments yield during a low-yield environment, which incentivizes those pension funds to become less risk averse and to move more money into risky assets. Reaching for yield becomes a popular strategy in this environment and your job covering pension funds will likely center around identifying investment opportunities with an expected return close to the funds yield target. A pension funds running a defined contribution scheme makes no promises regarding the investment performance and will likely continue a conservative investment strategy even in a low-yield environment.

The investment behavior of a pension fund also depends on whether the plan is growing (i.e., increasing premia are collected from additional plan participants) or declining (i.e., outflow payments to pensioners exceed inflows). If the plan is growing, the pension fund manager can still invest in long-dated assets that typically yield more than low-duration assets; if the plan is in decline, the fund manager must shorten the duration of portfolio assets, which further reduces the expected yield.
3.1.6 Insurance Companies

Insurance companies are in the business of assuming risk on behalf of their customers in exchange for a premium. Typically, premium payments are collected prior to payouts expected to occur, so that a significant portion of premium income needs to be invested in the market. As of 2017, assets held by insurance companies worldwide are to the tune of $33 trillion globally.\(^{11}\)

The protracted low-yield environment is eroding life insurers’ capital positions, particularly for companies offering products with long-term guaranteed rates and big duration mismatches between assets and liabilities. As a result, many insurance companies, just like pension funds, are allocating an increasing portion of their financial assets into more risky asset classes in an attempt to boost investment returns. According to a survey conducted in 2019, asset managers of 360 global insurance companies intend to increase asset allocations into private equity by 24% on average, into real estate by 21% and into hedge funds by 14% over the following 12–24 months.\(^{12}\)

3.1.7 Mutual Funds

With roughly $40 trillion in assets under management, mutual funds are the largest group of real money investors, accounting for about 40% of global assets under management. Mutual funds are investment vehicles whose underlying assets are identifiable and are marked to market on a regular basis.

Advantages of mutual funds include

- Liquidity/convenience;
- Size transformation;
- Diversification;
- Transaction cost reduction;
- Managerial experience.

Table 3.1 shows a ranking of the top-10 mutual funds as of January 2020. The top eight spots are occupied by US institutions.

Due to the intense competition between mutual funds, minimizing transaction costs has become a major issue in the industry. As a result, mutual funds are investing a lot of energy in developing trading platforms tailored toward cost-efficient and market impact minimizing portfolio trading. An example for such a platform is Aladdin®, an operating system developed by
Table 3.1  Global ranking of mutual funds as of January 2020 by AUM

| Global ranking | Institution            | AUM in $ bn |
|----------------|------------------------|-------------|
| 1              | BlackRock              | 6964        |
| 2              | Vanguard               | 4530        |
| 3              | Charles Schwab         | 3940        |
| 4              | State Street           | 2810        |
| 5              | Fidelity Investments   | 2459        |
| 6              | J.P. Morgan            | 2200        |
| 7              | BNY Mellon             | 1900        |
| 8              | PIMCO                  | 1880        |
| 9              | Capital Group          | 1860        |
| 10             | Amundi                 | 1750        |

*Source* Mutual Fund Directory (2020)

BlackRock for investment managers that provides risk analytics and tools for portfolio management, trading and operations. To some degree, this leads to a disintermediation of broker-dealers, reducing their ability to earn commissions and fees from mutual fund flows.

### 3.1.8 Index Funds

Index funds are special types of a mutual funds or exchange-traded funds (ETFs) with a unique investment style. Instead of actively managing the asset composition, index funds aim at passively replicating an existing market index.

Finance theory typically assumes efficient markets, including the notion of minimal transaction cost. There are indeed some very liquid markets, such as the institutional market for plain-vanilla swaps or institutional foreign exchange (FX) transactions. Fees charged by actively managed funds, however, are large enough to hurt performance (see Table 3.2), and over the last ten years or so, an increasing publicity was given to the empirical observation that the majority of mutual funds fail in providing above-market returns on an after-fee basis.\(^\text{13}\) As a result, an ever-increasing percentage of fund money is going into index funds that provide diversification benefits at much lower fees. For US equity funds, already more than 50% is invested in passives.\(^\text{14}\)

Among the index funds with the lowest expense ratio in the world is the Vanguard 500 Index Fund, replicating the S&P 500 stock market index. Its expense ratio (for investments of $3000 or more) is merely 0.04%, or 4 bp p.a.\(^\text{15}\) There is virtually no difference in performance between the
Table 3.2 Illustration of transaction cost

| Transaction                                         | Typical fee | Fee per $1 mm |
|-----------------------------------------------------|-------------|---------------|
| Liquid swap transaction with institutional investor  | ¼ bp        | $25           |
| Vanguard S&P 500 index fund                          | 4 bp p.a.   | $400          |
| Schwab Emerging Markets Equity ETF                   | 13 bp p.a.  | $1300         |
| Average stock purchase with non-online broker       | 1%          | $10,000       |
| Retail structured product                            | 1.5%        | $15,000       |
| Hedge fund                                           | 2%b p.a.    | $20,000       |
| Playing one round of roulette in a casino           | 2.7%        | $27,000       |

\(^{a}\)For example, Deutscher Derivate Verband (2018)

\(^{b}\)Calculated by assuming a 2% management fee (ignoring the profit fee typically 20%, that is charged additionally when performances exceed a certain threshold)

replicated index and the index fund: Since inception in November 2000 and December 2019, the index had a performance of 6.73% p.a., and the index one of 6.75% p.a.\(^{16}\)

From a broker-dealer’s perspective, index funds are quite unattractive customers. They execute (often algorithm-based) buy and sell orders proportional to security compositions within an index, have little or no discretion for security selection, are not inclined to pay for securities research, aim for the most cost-efficient way to transact and need little, if any, advise.

3.1.9 Hedge Funds

Hedge funds are part of a group of non-traditional investment funds called alternative investment funds.\(^{17}\) The term goes back to 1949, when Alfred Winslow Jones founded one of the first hedge funds with a capital of $100,000.\(^{18}\)

Initially, hedge funds aimed to deliver positive returns under all market conditions (so-called alpha) by hedging out all types of market risk (the “beta”). Soon after, hedge funds engaged in risky investment behavior, moving away from pure (risk-free) arbitrage, to “relative value,” to “informed bets” or market-directional trading.

Hedge funds can be classified according to their self-described investment style. However, often hedge funds give themselves so much latitude that they can do whatever they want, no matter how they market themselves to investors. Long-Short funds are taking long and short positions in stocks to limit their exposures to the stock market. Event-driven funds take positions on corporate events (corporate bankruptcies and reorganizations; merger
arbitrage). **Fixed income arbitrage** involves trading of price or yield along the yield curve. **Global Macro funds** rely on macroeconomic analysis to take bets on the major risk factors, such as currencies, interest rates, stock indices and commodities. **Multi-Strategy funds** don’t limit themselves to any strategy.

Hedge funds employ a wide range of *trading strategies*. These trading techniques are not unique to hedge funds. Many of them are used by university endowments, pension funds, wealthy family portfolios and proprietary trading desks of commercial and investment banks (where a number of hedge fund managers came from). Wall Street firms also regularly employ highly leveraged positions, especially when they use short treasury positions to hedge the corporate bonds and mortgage bonds in their inventory. Some wealthy families reportedly run their own trading operations much like those of hedge funds. More details about hedge fund trading will be discussed in Sect. 5.5 within the chapter on trading.

Some hedge funds, called **quantitative hedge funds**, focus on mathematical relationships among prices in what is called *statistical arbitrage* and have been founded by computer scientists, mathematicians and engineers. Two of the most successful quantitative hedge funds are *Renaissance Technologies LLC* and *Two Sigma Investments LP*. Renaissance is a $84 billion quantitative investment firm founded in 1982 by former military code-breaker Jim Simons. It is considered to be one of the most profitable hedge funds, returning an estimate 39.1% annualized (after fees) over a 30-year period from 1988 to 2018. It is a pioneer in quantitative trading, strictly adhering to mathematical and statistical methods. It employs mathematicians, statisticians, pure and experimental physicists, astronomers, and computer scientists; about a third of its about 300 employees are believed to hold a PhD. Two Sigma is a roughly $60 billion quantitative investment firm founded in 2001 by former mathematician and statistician John Overdeck. Its annualized return 2014–2017 is about 17%. Two Sigma is applying artificial intelligence, machine learning and a supercomputer-sized distributed computing platform to their trading strategies, utilizing some 42+ petabytes of data, more than 10 thousand public and proprietary data sources and almost 100 thousand CPUs providing 100 teraflops of computing power.

Hedge funds are known for the exorbitant salaries they pay to their best-performing traders. The *Institutional Investor* magazine publishes an annual list of the highest earning hedge fund managers, called “The Rich List.” According to the 2019 list, Ray Dalio from the hedge fund *Bridgewater Associates* earned $2 billion, James Simons from *Renaissance Technologies* $1.5 billion, Kenneth Griffin from *Citadel* $870 million, John Overdeck and David Siegel from *Two Sigma* $820 million each and Israel
England from *Millennium Management* $750 million. Some hedge fund managers have so much money that they buy themselves sport teams: In 2019, Steve Cohen (Point72 Asset Management, formerly SAC Capital) brought himself the New York Mets (baseball team) and David Tepper of Appaloosa Management is a minority owner of the Pittsburgh Steelers (football team) and bought the Carolina Panthers (football team) for $2.275 billion.

It is both a privilege and a challenge to cover hedge funds. A privilege because hedge funds are among the most sophisticated market participants in the market (although the failure of the one-famous hedge fund Long Term Capital Management, LTCM, has tarnished the reputation of hedge funds). They tend to hire only seasoned and exceptional staff and rigidly weed out underperformers. Hedge fund traders and strategists will likely refuse to talk to you unless you can demonstrate some ability to add value to them. They simply don’t have the patience and time to deal with someone they don’t consider being at their eye level. Once you established a line of communication, you can learn a lot of things you won’t find in textbooks or research publications. For example, as a salesperson or a research strategist, you may be able to interfere from the hedge fund’s reaction to a proposed trade idea, whether there are some conceptual flaws, errors in the trade construction (e.g., assumed weightings of the legs of the trade), market imbalances or structural changes that prevent the trade to perform the way anticipated (e.g., if it is some sort of mean-reverting trade) or other issues you have not considered yet. If you have a really good relationship with the hedge fund, you may even get direct feedback; often, however, the hedge fund will simply not react to your proposal and it is up to you to read between the lines. Hedge funds are notoriously tight-lipped because they don’t want to give away any of their advanced knowledge that sets them apart from the average investor. For traders it can be advantageous to deal with hedge funds as well, as they may learn about better ways to calibrate their pricing models or about other pricing-related issues. However, when it comes to hedge funds, traders often have to learn those things the hard way. This is because hedge funds will likely try to exploit any pricing and evaluation divergence by trading, causing a trading loss to the trader on the broker-dealer side. That’s why broker-dealer flow traders will make sure to transact only in rather small size (although hedge funds often pressure to do big-size trades). Refusing to trade with hedge funds is typically a short-sighted strategy, because then there is no more potential to improve modeling, pricing and calibration by interfering information from the hedge fund relationship, which often causes even worse trading losses in the long run.
Covering hedge funds can be quite a challenge. As already mentioned, hedge funds are often ruthless when it comes to exploiting any kind of mis-pricing they identify. For a trader, winning a trade with a hedge fund is a double-edged sword. On the one hand, there are many benefits to a confirmed transaction: The trader may have earned some commission, the trader may have offset some risk position for the trading book and the trade may have given some valuable insight into the hedge fund’s thinking process and market knowledge. On the other hand, the trade will likely suffer from the so-called winner’s curse, a phenomenon describing the doubt of a winning bidder in an auction that he/she may have had put in a too aggressive bid. Since hedge funds often request price quotes of instruments that need to be priced to model, being identified as the (from the hedge fund’s perspective) most attractive price quote among a group of broker-dealers with presumably excellent modeling skills raises the possibility that there was some error been made in the pricing process.

3.1.10 Sovereign Wealth Funds

Sovereign wealth funds are state-owned entities that own and invest a country’s pool of assets. For example, Norway’s sovereign wealth fund manages money in excess of $1 trillion originating from oil drilling revenues. The China Investment Corporation (CIC), also managing close to $1 trillion in investments, is in charge of investing a portion of China’s foreign currency reserves.

Table 3.3 shows a ranking of the top-10 sovereign wealth funds as of January 2020.

| Global ranking | Institution | AUM in $ bn |
|----------------|-------------|-------------|
| 1              | Norway Government Pension Fund Global | 1099 |
| 2              | China Investment Corporation | 941 |
| 3              | Abu Dhabi Investment Authority | 697 |
| 4              | Kuwait Investment Authority | 592 |
| 5              | Hong Kong Monetary Authority Investment Portfolio | 509 |
| 6              | GIC Private Limited | 440 |
| 7              | SAFE Investment Company | 418 |
| 8              | Temasek Holding | 375 |
| 9              | Qatar Investment Authority | 328 |
| 10             | National Council for Social Security Fund | 325 |

Source: Sovereign Wealth Fund Institute (2020)
Sovereign wealth funds differ from other investment funds in a number of ways. First, they do not merely follow economic objectives, such as capital preservation or risk-return optimization, but also have strategic and social goals. Second, they often delegate asset management to external asset managers. And third, because they view themselves as long-term investors, a significant part of their assets is held in less liquid private market instruments and alternative investments, such as private equity or real estate.

3.1.11 Central Banks

Among the most important market participants in the financial markets are central banks. Central banks are each country’s government authority in charge of monetary policy. Although central banks are technically part of the government, they often benefit from a large degree of independence and can be treated as separate decision makers.

The most important central banks in the global financial markets are the US Federal Reserve Bank (Fed), the European Central Bank (ECB), the Bank of England (BoE), the Bank of Japan (BoJ) and the Bank of Canada. Central banks perform many functions, whereas their monetary policy has the biggest impact on the financial markets. Monetary policy is actions taken by central banks to influence the cost and availability of money in an economy. To achieve this, a number of tools and measures are at a central bank’s disposal. So-called conventional measures (used in times without stress) are for example targeting the short-term risk-free interest rate and impact the front-end of the yield curve. Unconventional measures are additional operations in the open market, typically through limited-time repo transactions or outright security purchases, called Quantitative easing (QE).

Central banks’ discount windows (or standing facilities) are used to keep the interest rate at which depository institutions lend reserve balances to other depository institutions overnight close to the target established by the central bank. For example, the Federal funds (or Fed funds, for short) effective rate is the interest rate at which US depository institutions lend reserve balances on an uncollateralized basis to each other on an overnight basis. The Fed is steering this rate by “targeting” a desired rate level, called the Federal funds target rate. It is set by a meeting of the members of the Federal Open Market Committee (FOMC) which normally occurs eight times a year about seven weeks apart. Figure 3.3 shows how the US Fed has adjusted the target rate according to the economic environment: In 2001 and 2008, the target rate was reduced to stimulate the economy during recessions;
mid-2004 to mid-2006, the rate was pushed higher to fight inflation. The reduction in the first quarter of 2020 is to fight the adverse effects of the COVID-19 pandemic.

Some economic textbooks make it appear that a change in the central bank target rate has an impact on the market. This is wrong. What actually causes a market reaction is a deviation from market expectations. If the market already expects a 25 bp increase in the target rate and the central bank delivers precisely such a 25 bp increase, there will be likely hardly any change to (short-dated) interest rates in the minutes following the announcement. However, if the market widely expects a 25 bp increase and the target rate is kept unchanged, this would possibly create a market reaction akin to an unexpected decline of the target rate.\(^{27}\) For a proper analysis of the anticipated market reaction function to central bank activity one needs as a starting point a good estimate of what is already priced in by the market. Sometimes, there are liquid traded instruments that can be used to extract the implied market expectation. For example, for the future Fed funds target rate, one could look at the Fed funds futures market.\(^ {28}\) However, by simply comparing the Fed funds futures-implied interest rate to the current target rate, one cannot gauge the precise market expectation. This should be illustrated by the following example.

Let’s assume it is one day prior to an FOMC meeting in May with the current Fed funds target rate being 1%. The June Fed funds futures trades at a price of 99, implying an average daily Fed funds effective rate in the month of June of 1%.\(^ {29}\) With this information alone, it is not possible to say whether market participants expect an unchanged target rate with a
100% probability or, for example, a 50% probability of a 25 bp increase and a 50% probability of a 25 bp decline. Thus, futures prices only offer probability-weighted expectations and are not very useful to gauge information about the dispersion of believes.\textsuperscript{30}

Extracting market expectations from surveys of economists can be tricky as well. Chief economists of major broker-dealer firms are regularly polled and ask to provide a forecast for various economic releases. Each economist has to provide one single forecast and then the various forecasts are provided as a list, often together with some statistical analysis. Table 3.4 illustrates how a typical format of such a consensus forecast table looks like. If all economists were to see a high probability of an unchanged target rate and a low probability of, say, a Fed hike, they would all report an unchanged rate as their forecast. This would then look like there is no expected probability of a Fed hike, because nobody is projecting this scenario.

Besides the \textit{conventional} central bank policy measures aimed at changing the short-term interest rate, central banks engage in \textit{open market operations}. Those include limited-time transactions in the repo market as well as outright security purchases, so-called \textit{quantitative easing} (QE). Quantitative easing inflates a central bank’s balance sheet as more and more assets get absorbed (see Fig. 3.4 for the US Federal Reserve). The spike in the first half of 2020 is due to central bank action on the back of the COVID-19 pandemic. The reduced float of remaining assets in the market can create scarcity problems, as the cap for central bank holdings of individual securities is set quite high (70% for the Fed). Table 3.5 shows the Fed’s holding for selected Treasury securities as of May 2020. Although central banks try to mitigate undesired impacts on market functioning,\textsuperscript{31} temporary market

| Fed target upper bound | Q3  | Q4  | Q1  | Q2  | Q3  | Q4  | Q1  |
|------------------------|-----|-----|-----|-----|-----|-----|-----|
|                        | 2020| 2020| 2021| 2021| 2021| 2021| 2022|
| Median                 | 0.25| 0.25| 0.25| 0.25| 0.25| 0.25| 0.50|
| High forecast          | 0.50| 0.50| 1.25| 1.50| 1.75| 2.00| 2.50|
| Low forecast           | 0.25| 0.25| 0.25| 0.25| 0.25| 0.25| 0.25|
| % of forecast at median| 96  | 93  | 90  | 88  | 85  | 85  | 50  |
| No. of forecasts at median | 67  | 65  | 61  | 60  | 51  | 51  | 18  |
| No. of forecasts       | 70  | 70  | 68  | 68  | 60  | 60  | 36  |
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Fig. 3.4 Federal Reserve’s balance sheet, 2007–2020 (Graphic shows the total assets of the Federal Reserve. Source Board of Governors of the Federal Reserve [2020])

![Federal Reserve’s balance sheet, 2007–2020](image)

Table 3.5 Federal Reserve’s security holdings for selected securities

| Instrument (CUSIP) | Maturity date     | Coupon (%) | Par value (billion) | Total outstanding (%) |
|--------------------|-------------------|------------|---------------------|-----------------------|
| 912828SF8          | 15 February 2022  | 2          | $45.1               | 60.8                  |
| 912828SV3          | 15 May 2022       | 1%         | $44.2               | 64.1                  |
| 912828TJ9          | 15 August 2022    | 1.625      | $44.1               | 66.8                  |
| 912828QN3          | 15 May 2021       | 3.125      | $40.0               | 60.6                  |
| 912810QU5          | 15 February 2042  | 3.125      | $31.5               | 66.7                  |
| 912810QE1          | 15 February 2040  | 4.625      | $                  | 70                    |

Table shows the domestic security holdings for selected Treasury Notes as of May 17, 2020. Source Federal Reserve Bank of New York [2020]

Dislocations and dysfunction may arise. Therefore, it is important to closely monitor how much of a particular security a central bank buys and whether this had caused any price dislocation.

3.2 Key Concepts of Financial Theory

Financial theory is a very wide field stretching from simple concepts of financial mathematics, such as net present value (NPV) calculations, over complex theories of financial economics, such as the capital asset pricing model (CAPM) to psychological aspects of human behavior in behavioral finance. It is impossible to cover all of them in one section. It is also not possible to objectively select the most important ones, as their applicability and
usefulness depends on the specific area of use. What follows here is a selection of concepts I found particularly useful in a sales, trading and research environment. The choice is subjective. Ultimately you need to compile your own theoretical toolkit that serves you best, that allows you to differentiate yourself and that makes you more convincing when interacting with other market participants. What I am suggesting here is what I believe to be the theoretical equivalent to a screwdriver, hammer and pliers in a beginner toolbox.

### 3.2.1 Choice Under Uncertainty and Risk

Financial markets are all about information. Is there some information not yet reflected in the market price? Can we extract information from the observed market dynamics? Do we have information about what could happen next? Typically, one of the first questions before even starting the most basic financial analysis is: *What do we know?* This seems obvious, but this is an area where often wrong assumptions are made already. At the early morning of Tuesday, September 11, 2001, everyone believed to *know* that trading on the following day, a non-holiday Wednesday, would be possible on the New York Mercantile Exchange. And yet, after the attack on the World Trade Center, the exchange was closed for a week.

Donald Rumsfeld, in a speech given on February 12, 2002, popularized the distinction between different levels of knowledge:

> “[T]here are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – there are things we do not know we don’t know.”

Unknown unknowns are rare, but problematic events, because market participants have not considered their impact at all. Risk management, pricing, hedging and many other techniques are doomed to fail. Going forward, terrorist attacks on critical financial market infrastructure are no longer unknown unknowns, as we are now aware of the possibility of this to happen again. For example, infrastructure safeguards have been put in place (backup server locations, etc.). But eventually, there will be something happening again, that no one has considered to be realistically feasible.
More common than unknown unknowns are known unknowns. Here, we know that something is unknown. For example, we know that we don’t know a central bank’s target interest rate two years from now. Still, we have to make choices such as whether or not to protect a floating-rate liability against increasing interest rates on the back of monetary tightening. What is the rational choice to make? Going back to a distinction made first by Frank Knight in 1921, there are known unknowns for which the probabilities of the relevant outcomes are both meaningful and known, and there are known unknowns where the probabilities of the relevant outcomes are completely unknown or not even meaningful. In the former case, one is facing choice under risk, in the latter choice under uncertainty. See Table 3.6.

| Known Knowns | Known Unknowns | Risk | Uncertainty | Unknown Unknowns |
|-------------|----------------|------|-------------|----------------|
| Examples    | Examples       |      |             |                |
| Risk-free rate | Probability of a traded option to be in-the-money | Default of a customer loan | Unexpected wars |
| Risk-free cash flows | Change of interest rates | Greece leaving EU | Environmental disaster |
| Maturity of non-callable bond | Calendar | Terrorist attack | Regime changes |
| Calendar | | | Aliens coming from outer space |
| Assessment | Assessment | Assessment | Assessment | |
| Unproblematic | Risk Management & Hedging | Probabilities must be assumed | Problematic |
other security that is part of the deliverable basket would be more expensive. Also, one assumes that delivery takes places at the day during the delivery month that is most advantageous to the short position. Let's assume that widely available futures research suggests that long positions in a particular futures contract should expect to get the CTD security delivered on the last date of the delivery month. Let's also assume that you have no interest (or even worse: not the technical ability) to take delivery of the CTD; in fact, you plan on closing out the futures position prior to delivery. Taking the futures research analysis as a known known, you hold on to the futures position during the delivery month, “knowing” that delivery will not happen until the very last day of the delivery month. This is an example of how dangerous it can be to blindly trust known knows. While it may be true that a rational actor would not deliver prior to the last delivery day if that is not the most profitable course of action, there is no guarantee that the long position in the futures contract could in fact deliver the CTD, or any other deliverable security, prior to the last delivery day. This could put you in a very uncomfortable position of having to take physical delivery of the underlying.

Another example relates to implied probabilities. Let's assume you are a salesperson covering a corporate customer who fears that interest rates could increase. This would drive up financing costs, as the corporate customer issues 10-year corporate bonds as the main debt financing instruments. Your customer asks you what the probability of an increase in 10-year corporate bond rates of 100 bp over one year is. He needs this information within 5 minutes, because he wants to use it in an internal meeting that is about to start. In a situation like this, it is more important to provide the customer with an approximative answer in time, rather than taking too long for a precise solution. There is no time to make assumptions about the expected change in the corporate bond spread, so you assume for simplicity that the probability of a 100 bp increase in the corporate financing rate is approximately the same as the probability of a 100 bp increase in the 10-year swap rate. You then ask the swap desk to indicate to you what the delta of a one-year-into-10-year receiver swaption struck 100 bp above the current spot rate is. The delta of an option is not the same as the probability of execution, but as a very rough approximation this will need to do. If the delta of the swaption is, say, 0.25, you could indicate to your client that the probability of a 100 bp rate increase over a 1-year period is somewhere around 20–30%.
3.2.2 The Efficient-Market Hypothesis

The efficient-market hypothesis (EMH) was developed by Eugene Fama in 1970. EMH is a theory in financial economics that states that an asset’s prices fully reflect all available information. It comes in three versions:

- **Weak-form EMH**—Future prices cannot be predicted by analyzing prices from the past. Excess returns cannot be earned in the long run by using investment strategies based on historical data;
- **Semi-strong-form EMH**—Prices adjust to publicly available new information very rapidly and in an unbiased fashion, such that no excess returns can be earned by trading on that information;
- **Strong-form EMH**—Prices reflect all information, public and private, and no one can earn excess returns.

What makes the EMH such a valuable contribution to financial theory is that it made people think about market efficiency. Whether or not a market is efficient is often a question of perspective. To a market participant executing trades via voice channels, a market in which prices adjust in the blink of an eye is totally efficient. To a hedge fund that has a 3 milliseconds advantage in transmitting orders between New York and Chicago through a dedicated microwave network, the same market may look inefficient, allowing for latency arbitrage opportunities.

It is dangerous to leap to a conclusion about a market’s efficiency. If the assumption is that a market is strong-form efficient, it would be impossible to systematically outperform (or, “beat”) the market on a risk-adjusted basis by analyzing information. This notion was probably first formulated in 1973 quite eloquently in the Malkiel (2014) book *A Random Walk Down Wall Street*: “A blindfolded monkey throwing darts at a newspaper’s financial pages could select a portfolio that would do just as well as one carefully selected by experts.” On the other hand, the notion of a market being informationally inefficient appears suspicious, also. How come other market participants are not taking advantage of this by trading on information not yet reflected in the price, generating a profit for themselves and driving the market price toward informational efficiency by doing so? If you claim having found an inefficiency (mispricing, arbitrage opportunity, etc.), you must be prepared to answer some tough questions. Are you faster than everyone else in transmitting information (e.g., latency arbitrage)? Are you more...
efficient in analyzing information (e.g., utilizing AI and machine learning)? Do you have access to privileged information (e.g., insider trading)? Are you able or willing to act other market participants are prevented from doing (e.g., being unaffected by regulatory restrictions or willingness to break the law)?

How can a market be efficient and, at the same time, incentify market participants to process information (conduct financial market research, etc.) that drives the market toward efficiency? Grossman/Stiglitz raised this question in 1980 and proposed that markets cannot be completely efficient. There appears to be an efficient degree of inefficiency that creates an equilibrium between market participants searching for, and profiting from, market inefficiencies and participants relying on market prices: “Prices are pushed away from their fundamental values because of a variety of demand pressures and institutional frictions, and, although prices are kept in check by intense competition among money managers, this process leads the market to become inefficient to an efficient extent: just inefficient enough that money managers can be compensated for their costs and risks through superior performance and just efficient enough that the rewards to money management after all cost do not encourage entry of new managers or additional capital.”

As a sales, trading and research market professional, you will perform two different roles in efficiently inefficient markets. At times, you will need to rely on market prices to extract implied information. Here, you assume the market to be (sufficiently) efficient and benefit from the informational value of market prices. For example, you observe Eurodollar futures prices and calculate the implied Eurodollar rate (100 minus the futures price) without questioning whether the market is efficient enough to have properly converted yields into prices in the first place. At other times, you will find yourself in the position to hold information that are not yet fully reflected in the market price yet (or so you think), in which case you will assume the market to be temporarily inefficient. You will probably consider this to be a market dislocation and may want to take advantage of it (e.g., by trading or communicating your observation to other market participants that will compensate you for it one way or another).

At times, you will face contradictions regarding market efficiency. Take this example: You believe to have found a mispricing in a traded option. In order to benefit from the market inefficiency, you plan to trade the option and hedge it with a delta-equivalent position in the underlying. But what is the delta of the option? If you don’t trust the market to calculate the correct option price, you surely can’t assume the market to provide you with the proper delta (sensitivity) either. Should you, therefore, hedge according to
hedge ratios generated by your own model? Or does your internal risk management group force you to use risk parameters from the market? There is no easy answer to this question.

### 3.2.3 Arbitrage

Arbitrage is another important concept in financial theory. In this section, we will be covering three nuances of the concept of arbitrage: pure arbitrage, market micro-arbitrage and relative value. Then we look at one specific example of arbitrage, institutional arbitrage.

#### 3.2.3.1 Pure Arbitrage

The theoretical definition of arbitrage, often referred to as pure arbitrage or riskless arbitrage, is simultaneous buying and selling of identical securities that requires no capital (i.e., “self-financing” trades), locks in an instant profit or profit opportunity and creates no risks of any kind. Theory does not define arbitrage in a constructive way to help market practitioners make money. For that, the definition is way too restrictive. How many trade opportunities are there that create absolutely no risk (not even reputational or regulatory risk)? Is there any way to trade with absolutely no capital (given that some regulatory requirements demand a minimum capital adequacy from many institutional investors)? Scholars came up with the definition of arbitrage primarily to test whether a theory is arbitrage-free. Because a theory or a model that allows for arbitrage opportunities would violate a number of assumptions financial theory is based on. For example, neoclassical models tend to assume all actors to be rational (e.g., maximizing profit or maximizing utility). It would be a contradiction to assume rationality and at the same time to assume that subjects are not increasing profits and utility by exploring existing arbitrage opportunities. It would also violate the assumption that prices react to changes in supply and demand (taught in microeconomics 1.0.1 courses) when we allow for arbitrage trading to persist without prices to move toward an arbitrage-free equilibrium.

#### 3.2.3.2 Market Micro-Arbitrage

It is fair to say that for the majority of market participants it would be a total waste of time to be looking for arbitrage opportunities in liquid, developed financial markets. Also, traders considering themselves “arbitrageurs”
typically do not look for pure arbitrage but for good bets. Those bets are still risky. The kind of arbitrage opportunity that present itself every now and then in the real markets is so-called market micro-arbitrage. This type of arbitrage is less restrictive than then pure arbitrage found discussed in textbooks and can be characterized as follows:

- Simultaneous buying and selling of different, but highly related securities;
- Usually of short-term nature;
- No, or little, market directionality;
- Exploiting temporary market imbalances due to lagging price adjustments in different markets and sudden, large order flows.

Almost always when proposing a potential market micro-arbitrage opportunity, the question comes up what had caused the dislocation in the first place. If you cannot explain the driver of the dislocation, you cannot assess how likely it is that the dislocation will disappear again. A good micro-arbitrage trade takes advantage of a dislocation created by some events in the market that are known to be transitory in nature. Those trades are sometimes pitched as mean reversion trades. However, markets can stay “dislocated” for a long time, so timing is critical. For example, if you have identified buying of US Treasury securities by the Chinese central bank as a cause for US Treasury bonds trading expensive, it would not be a good market micro-arbitrage trade idea to propose selling US Treasury bonds vs. buying some other highly correlated assets unless you also believe that buying by the Chinese central bank is about to stop. If, on the other hand, your analysis suggests that there is a lot of US Treasury bond buying during the last weeks of a year due to major market participants’ window dressing in the balance sheet, then selling Treasury bonds in December and buying them back in January may be a reasonable market micro-arbitrage trade idea.

### 3.2.3.3 Relative Value

Market micro-arbitrage opportunities are actually hard to find. Very often, what is labeled as “arbitrage” is upon closer inspection nothing more than a trade someone considers attractive. A better name for this would be is relative value and can be described as follows:

- A general term that includes arbitrage but also refers to positions with residual risks;
- Potential gains seem to outweigh potential losses (attractive risk/return profile);
• Historically unusual price constellations which are expected to revert back to mean.

Relative value analysis is a process of gaining insight into the relationship between different instruments and the forces driving the process. The concept of relative value bases on two economic principles:

• If two securities have identical payoffs in every future state of the world, then they should have identical prices today (“law of one price”);
• If two securities present investors with identical risks, they should offer identical returns.

3.2.3.4 Institutional Arbitrage

Internal policies and self-imposed restrictions of many institutional investors (pension funds, money market funds, insurance companies, etc.) restrict their investment behavior. When it comes to bonds, they often use credit ratings as a basis for their investment decision. For example, it is common practice to invest only into investment grade bonds (rated “BBB” or better by the major rating agencies) and not into sub-investment grade (also called high yield, or junk) bonds. This institutional limitation creates excess demand for investment grade instruments, which drives down their yield. Through slicing a sub-investment grade pool into tranches which are partly investment grade, one creates more demand from institutional investors, resulting in an overall lower yield (higher price) of the structured product (see Fig. 3.5).
Another way to look at this is to observe that rating agencies fail to assign ratings to individual tranches that would prevent institutional arbitrage. Therefore, one could also view this as credit ratings arbitrage.

3.2.4 Agency Theory

Agency theory is a very powerful concept that helps explain a lot of behavior in the financial markets. Formalized first in Jensen and Meckling (1976), it concerns itself with the problems arising when one person, the agent, makes decisions on behalf of another person, the principal. The theory acknowledges that the principal and the agent both act in their own interest, which may diverge, creating conflicting interests.

Additionally, the agent has information unknown to the principal, referred to as asymmetric information, which makes it difficult for the principal to ensure that the agent acts properly. Asymmetric information can lead to adverse selection, a situation in which the principal can no longer trust the agent and has to assume the worst. Adverse selection can cause market participants to withdraw from the market, with the potential for a market collapse.43

Without agency theory, it is virtually impossible to address questions like those in a meaningful way:

• Why does bank management pay itself huge boni (even in years when the bank is losing money)?
• Why do traders often take more risk than what is beneficial for their employer?
• Why do financial market participants with an explicit or implicit government guarantee engage in overly risky business practices?
• Why do portfolio managers sometimes make asset allocations that are not in the best interest of the end-investor?
• Why did rating agencies systematically underestimate the risk of structured mortgage securities prior to the financial crisis of 2007–2008?

Agency theory formally challenges the notion that agents should always be assumed to act in the best interest of the people they represent. In fact, it would be quite naïve to think so. Hypothetically, if medical doctors’ compensation would only depend on the price of the medication they prescribe, would you be surprised to learn that patients are prescribed more drugs
than is good for them? Because if not, you shouldn't be surprised about many observations in the financial markets either, such as that mergers and acquisitions (M&A) departments (that receive the majority of their compensation only if an M&A transaction takes place) are promoting more M&A transactions than necessary and that a large number of M&A transactions turn out to be a disaster for the buyer as a consequence.

Often, there is a chain of principal-agent problems in the financial markets. For example, end-investors appoint mutual funds to manage their money; mutual funds hire portfolio managers to make financial decisions within the mutual funds' investment policy; portfolio managers appoint broker-dealers to assist in the execution of trades; broker-dealers hire registered representatives (salespeople) to cover portfolio managers. Salespeople executing trades and end-investors impacted by the performance of those trades will likely never meet face-to-face.

There are several interests and information asymmetries along the chain connecting the ultimate principal (the end-investor) and the ultimate agent (sales agent). The sales agent may receive a bonus partially based on the amount of transactions he/she conducts, creating an incentive to trade more than necessary. The portfolio manager may receive a compensation based on the annual outperformance vis-a-vis a given benchmark with no participation in case of a loss, creating an incentive to invest in assets that are expected to outperform the benchmark most of the time, but occasionally lead to significant losses.

The longer the chain connecting the ultimate principal to the ultimate agent, the more severe the quality of decision making is impacted by diverging interests. It appears that over time the chains have become longer and longer in the financial markets. For example, the predominant investment banks used to be partnerships. The head of bond trading, being one of the partners, would have skin in the game and would personally make sure that only an appropriate level of risk is been assumed by the bond trading desk. Nowadays, the same head of bond trading reports to the head of interest rate trading, who reports to the head of FICC trading, who reports to the regional chief executive officer (CEO) of a country, who reports to the global CEO, who is appointed by the board of directors, who represent the shareholders. Is it still reasonable to assume that the head of bond trading will always act in the best interest of the shareholders?

Because of diverging self-interest and information asymmetries, both the principal and the agent occur cost, called agency cost. According to the Jensen/Meckling framework, this includes:
• *Monitoring expenditures* by the principal. For a buy-side client mandating a sell-side broker firm with trade execution this could mean: Annual review of broker execution quality; putting trades in competition; investing in own pricing models/systems.

• *Bonding expenditures* by the agent: For a sell-side broker firm this could include client entertainment expenditures to strengthen the relationship.

There is a third cost element, described by Jensen/Meckling as *residual loss*. It results from inefficient behavior due to conflicting interests. For a buy-side client mandating a sell-side broker firm with trade execution this could mean: Excess transaction cost due to overtrading and sub-optimal risk allocations.

**Notes**

1. A broker-dealer is a sell-side financial market participant that trades securities with customers. When trades are executed on behalf of the customer at a third-party trading venue (e.g., a stock exchange), the broker-dealer acts as a broker; if the broker-dealer assumes the other side of the trade (e.g., in an over the counter swap transaction), it is acting in the capacity of a dealer.

2. Sometimes, the differentiation between buy-side and sell-side gets complicated. For example, the asset management group of a sell-side firm would be considered to be the buy-side from another sell-side firm’s point of view.

3. We are going to discuss the general concept of principal-agent problems causing conflicts of interest from a theoretical point of view in Sect. 3.2.4.

4. Lautenschläger (2017).

5. For example, there are very few issuers of AAA-rated instruments, while demand from institutional investors is quite high.

6. Shadow banking is sometimes also referred to as “non-bank financial intermediation.”

7. A repo, short for repurchase agreement, is a collateralized, short-term financing transaction between institutional investors. Details of repo transactions will be discussed in Sect. 5.9.1.

8. Financial Stability Board (2019, 4).

9. Source: OECD (2020).

10. USA, UK, Australia, Netherlands, Canada, Japan and Switzerland.

11. Rudden (2019).

12. BlackRock (2019, 15).

13. E.g.: Newlands and Marriage (2016).

14. Source: Schramm (2019).
15. In a cut-throat price war among low-cost index funds, other asset managers have lowered their fees to similar levels, e.g., BlackRock, Lyxor and State Street.
16. Vanguard (2020).
17. They also include private equity funds, infrastructure funds, commodity funds, real estate funds or other special funds.
18. Russell (1989).
19. Zuckerman (2019, 333).
20. Taub (2019b).
21. Hope (2015) and Two Sigma (2020).
22. Taub (2019a).
23. A complex transaction that involves the execution of more than one instrument is said to have several “legs,” with each leg referring to a specific part of the multi-asset trade. For example, a bond-switch (buying one and simultaneously selling another bond) has two legs. Also, in derivatives, a leg refers to an isolated cash flow. For example, a generic fixed-to-floating interest rate swap has two legs, the floating leg that specifies the cash flows based on a floating rate and the fixed leg that defines the reoccurring, fixed payments based on a fixed interest rate.
24. It should be inserted here parenthetically that not all hedge funds are as smart and sophisticated as the well-known leaders in the hedge fund industry. Because of the high fees, many former salespeople and traders are inclined to try their luck in establishing a hedge fund, only to find out that they lack the skills to generate excess returns. Some hedge funds have little information advantage and all they do is providing leveraged exposure to a particular asset class. If that asset class turns out to perform well, they look good and succeed in raising more money. Eventually, the asset class underperforms, causing the hedge fund to go out of business. However, up to that point the hedge fund collects significant fees (typically 2% of AUM annually).
25. Alarm bells would go off with the trader if, immediately after a sizable transaction with a hedge fund had been confirmed, the hedge fund would ask whether another transaction of the same, or even larger size, could be done at the same price level.
26. Reserve management can also have a market-moving impact at times. Central banks primarily hold reserves to defend the exchange rate against destabilizing outflows and to be able to provide foreign currency liquidity support to domestic banks.
27. This is a simplification because in reality the accompanying announcement of the central bank also needs to be taken into consideration. For example, if the market had expected a 25 bp increase, the central bank then kept the rate unchanged but also announced strong indications that a 25 bp
rate hike, and possibly more, is to come soon, the market may not react as strongly at all.

28. Fed funds futures contracts are based on the simple average of the daily Federal funds effective rate for the delivery month. For non-business days, the Fed funds effective rate of the previous business day is used. Fed funds futures offer only an approximation of the expected Fed funds target rate for a number of reasons. First, the Fed funds futures contract is based on the average daily Fed funds effective rate, not the target rate. While those two rates are typically very close to each other (as the Fed actively trying to achieve this), there can be a systematic difference between them. Also, while forward rates are the best unbiased predictors for future yields, future-implied rates are not due to the bias created by margining requirement (technically, a convexity adjustment would be necessary to eliminate this bias).

29. Fed funds futures are quoted as a price that is calculated as 100 minus the implied interest rate expressed as a percentage number. We make the following simplifying assumptions: There is no chance that the Fed has an unscheduled meeting (i.e., between formerly announced FOMC dates) in June; the spread between the effective and the target rate is zero; the convexity adjustment between futures and forwards is neglectable; the FOMC will always move rates in 25 bp increments.

30. To estimate the dispersion of believes, one could try to extract conditional probabilities from the option market.

31. For example, by lending out securities in the repo market and by excluding securities in high demand (on-the-run Treasuries, cheapest-to-deliver securities into a futures contract, securities trading special in repo) from the purchase program.

32. Donald Rumsfeld, Defense Department Briefing, February 12, 2002, accessed at https://www.c-span.org/video/?168646-1/defense-department-briefing.

33. Some investors prefer to be long convexity (long optionality) for this reason alone. Something unexpected may happen at any point in time, and it is better to own securities that benefit from unexpected events than those that lose value.

34. Knight (1921).

35. Angner (2016).

36. Assuming that there is no market for credit protection for this particular customer (e.g., credit default swaps) that would allow to extract the implied default probability, or any credible credit assessment (such as a rating by a rating agency) available.

37. This is the case for a number of reasons. First, the delta of an option, using a Black Scholes option pricing formula, is N(d1), while the probability of the option to be struck in the risk-neutral world in N(d2). Second, even when using N(d2), this is a risk-neutral probability (or, technically speaking, an
object of the $\mathbb{Q}$ measure) as opposed to a real probability (i.e., a $\mathbb{P}$ measure). To convert from the $\mathbb{Q}$ to the $\mathbb{P}$ measure, one would have to have independent knowledge of the market’s utility function or the market price of risk.

38. Fama (1970).

39. Ever since, a number of experiments have been conducted with monkeys and with people simulating monkeys. In 2016, the Financial Times evaluated the performance of portfolio managers, not vis-a-vis monkeys, but compared to the average market performance, and found that “(...) 99 per cent of actively managed US equity funds sold in Europe have failed to beat the S&P 500 over the past 10 years, while only two in every 100 global equity funds have outperformed (...)”; see Newlands and Marriage (2016).

40. Grossman and Stiglitz (1980).

41. Pedersen (2015, 4).

42. There are two examples of mispricing that come very close to pure arbitrage, although they are both from the 1980s and disappeared (i.e., got “arb’ed out”) over time. The first relates to trading long dated FX forwards vs. currency swaps. For a few years, FX forwards traded as a separate market where prices were quoted by brokers based on supply and demand. At the inception of the currency swap market, one was able to trade currency swaps against FX forwards and arbitrage the two markets under a single ISDA agreement. The second example bases on the convexity of Eurodollar futures. In the early days of the interest rate swap market, the longer dated Eurodollar futures traded at comparable yields to interest rate swaps, although, unlike swaps, futures have zero convexity. As a result, one was able to set up risk-free positions with positive convexity. Thanks to Richard Leibovitch for pointing those examples out to me.

43. See Akerlof (1970).

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