This handbook is based on First Quadrant’s internal research and is not intended to provide specific investment advice. Except as otherwise noted, the analysis throughout this document is based on a time period of January 1980 to December 2016 and uses the following proxies for the referenced asset classes: Global ex-US equities is a simulated basket of developed market equities based on MSCI World Index; Global ex-US bonds is a simulated basket of developed market bonds based on the Citi World Government Bond Index; US bonds is simulated US bonds based on the Citi World Government Bond Index; EM equities is the MSCI Emerging Markets Index; and EM bonds is the JPMorgan GBI-EM Global Composite Index. Please see the end of this paper for further details on these proxies.

Past or simulated performance is no guarantee of future results. Potential for profit is accompanied by possibility of loss.
The purpose of this handbook is to serve as a reference for investors when determining whether and how to manage the currency exposure arising from their holdings of foreign assets. The handbook covers the main aspects of managing currency exposure and is designed for efficient use. Individual chapters are self-contained, so the reader may select only those chapters of greatest interest. This handbook is intended to be used as a tool for practitioners, and some technical details have been left out to keep the document to a manageable length. When technical terms are used, they are explained in the text. This version of the handbook is for US dollar base currency investors. The framework of analysis remains the same for all base currencies, however, although the data and some results will be different for non-US dollar investors.
INTRODUCTION

The handbook is organized as follows. We begin with an Executive Summary that highlights the main considerations discussed in the body of the handbook. In Chapter 1, we establish the importance of having a currency policy, due to the significant impact of currency on portfolios. Currency impact has been rising in recent years and the evidence suggests that it will rise further. Optimal management of this currency risk provides opportunities for managing the overall portfolio more efficiently.

In establishing a currency policy, investors should address two key questions. The first is what strategic hedge ratio to adopt. The strategic hedge ratio is an investor’s internal currency benchmark. Analogous to strategic asset allocation, it’s the static foreign currency exposure that best satisfies the investor’s long-term objectives. Chapter 2 provides a roadmap that investors can use to determine their strategic hedge ratio.

The second key question is whether currency exposure should be managed passively (i.e., implementing the strategic hedge ratio on a static basis) or actively. In Chapter 3, we equip investors with the arguments and evidence so they can make an informed decision.

Having chosen the strategic hedge ratio and whether to manage passively or actively, investors are in a position to implement their currency policy. Chapter 4 covers aspects of implementation – instruments, counterparties and information flows – to help ensure the smooth operation of the currency policy. Chapter 5 is on monitoring the currency policy. Its purpose is to indicate what kinds of ongoing reports and flows of information will be needed to ensure that the results of their currency policy are correctly interpreted and therefore more likely to be adhered to throughout a currency cycle. The final chapter provides a summary and conclusion.
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EXECUTIVE SUMMARY

Currency risk is a significant source of unrewarded risk for many investors. If mitigated, currency risk can be redeployed into better return-seeking opportunities.

Investors should adopt a currency policy addressing two main questions:

- What is the hedge ratio that best meets their investment objectives?
- Should currency exposure be managed passively or actively?

Our analysis for US dollar investors shows that the optimal hedge ratio for global ex-US developed equities is around 75%, though in practice, ratios from 50% to 100% can still result in a meaningful improvement in portfolio return/risk ratio. The 50% hedge ratio has attractive properties, for example, providing 80% of the benefits of a 75% hedge while also allowing for symmetry in the hedging activity around the benchmark.

The Currency Hedging Handbook is a reference for investors when determining whether and how to manage the currency exposure arising from their holdings of foreign assets. The handbook is tailored for US dollar base currency investors, though results are similar for other base currencies; analysis for other base currencies is available upon request.

Importance of having a currency policy

An investor’s currency policy consists of a strategic hedge ratio that maximizes expected return/risk (or some other investment objective) and a method for implementing the policy, either passively or actively. Currency policy should be an integral part of every investment program that invests in foreign assets because unhedged currency exposure can be a significant portion of an investor’s risk budget.

Some investors refrain from hedging currency because they believe currency exposure is a source of diversification. If this were true, then the risk of a portfolio with currency exposure would be lower than the risk of the same portfolio with hedged currency exposure. Our analysis shows that this is not the case: currency exposure consistently increases portfolio risk.

For an investor with global ex-US developed equities, currency exposure adds 2.6% to volatility compared to a fully hedged position, an 18% increase during the time period 1980-2016. With global ex-US developed bonds, currency risk dominates,
adding almost 6% to the volatility and more than doubling the risk compared to a fully hedged position.

Currency risk can also have a meaningful impact on a diversified portfolio. For an investor with 60% equities and 40% bonds, hedging the currency exposure of foreign developed equities reduces portfolio risk by the same amount as a 7% shift from stocks to bonds.

The risk reduction provided by hedging foreign currency risk allows the investor to reallocate the risk to higher-returning assets, which can aid in meeting overall investment objectives.

**Why now?**

Currency risk has been growing in portfolios as allocations to foreign assets have been increasing, and exchange rate volatility has been rising from relatively low levels. For investors who haven’t yet put in place a currency policy, there are strong arguments for doing so in the near future.

**Strategic hedge ratios**

For an investor who seeks to maximize return per unit of risk, the strategic hedge ratio can be determined using the same inputs used in developing a strategic asset allocation: expected returns, risks and correlations for the assets and currencies. We undertake the analysis for each international asset class separately as they have very different volatilities and correlations to foreign currencies.

Unmanaged currency risk should not be expected to generate a positive (or negative) return. It is not like other risk premia such as the equity risk premium or bond term premium. Empirically, the returns to unmanaged currency exposure over long time periods have been small, 0.5% per annum, and depend on the time period.

The correlation between the returns of foreign developed equities (currency hedged) and currency is close to zero on average, though it varies over time. If the correlation were persistently and significantly negative, currency exposure might be diversifying, but this is not the case.

Currency volatility has also fluctuated over time, although we have not detected any persistent trends in volatility since 1980. Some have argued that globalization should reduce the currency-related risk of foreign equities, but we find no evidence of this, either in equity returns or in corporate earnings.

**Non-US developed equities**

Our analysis shows that for a US dollar base currency investor, the optimal strategic hedge ratio for global ex-US developed equities is right around 75%. In practice, however, hedge ratios from 50% to 100% also provide substantial benefits. One important conclusion is that it’s difficult to justify, from an investment efficiency standpoint, having a currency benchmark that is unhedged. Nevertheless, unhedged benchmarks are not uncommon. This implies that for many investors, a meaningful improvement in portfolio return/risk can be readily achieved by implementing a strategic hedge ratio between 50% and 100%.
EXECUTIVE SUMMARY

Non-US developed bonds
For global ex-US developed bonds, the optimal hedge ratio is 100% because unrewarded currency risk dominates bond market risk.

Emerging markets
For emerging market (EM) equities and bonds, much of their macroeconomic and political risk is transmitted through the currency markets, so hedging currency would remove much of what gives emerging markets their distinctive characteristics. The strategic hedge ratio for EM equities and bonds is zero (unhedged).

Alternative assets
A currency policy should cover all foreign assets, including illiquid and alternative assets, and the framework presented in the handbook can be extended to these investments. Because holdings in alternative asset classes vary substantially from one investor to another, it is not possible to compute a single optimal currency hedge ratio that would apply to all investors. Investors should carry out analysis that incorporates the specific aspects of their holdings in alternative assets.

Active or passive management
The second part of the handbook assembles the data and reasoning needed for an informed investigation of whether currency exposure should be managed actively or passively. Investors should approach this question for currency in the same way as for equities, bonds and other types of investments. We address two main questions: 1) Are there reasons to believe the currency universe offers opportunities to add value consistently? 2) Can skilled managers with sufficient capacity be identified in advance?

There are conceptual reasons to believe currency markets may not be perfectly efficient, and the data supports this belief. Traditional concepts of market efficiency don't apply as well in currency markets as in, e.g., equities or fixed income, because for many of the participants in currency markets, the primary objective is not necessarily maximizing the value of their currency exposure. Instead, for them, currency is a means to an end—a medium for exchanging money for goods and services across borders.

Historical performance of active currency managers also supports the notion that currency markets are not as efficient as, e.g., their equity counterparts. The median active currency manager had a significantly higher information ratio, on average, than the median active global equity manager from January 2002 to December 2016. Another piece of evidence on opportunities to add value in currency is the performance of factor-based strategies. We looked at three naïve factors that have been well-known for many years: value, carry and trend. Each of these generated positive returns (transaction costs and fees are not considered) from September 2000 to December 2016, as well as the equally weighted combination of the three factors.
Implementation and monitoring  
The final chapters of the handbook cover implementation and monitoring. These are crucial aspects that require careful attention to ensure that investors get the most out of their chosen currency policy.

Investors should take care to understand the various instruments available in implementing their currency hedging policy, as different instruments not only provide differing advantages, they expose the investor to different risks. For example, over-the-counter currency forwards (the most commonly used instrument) allow the investor to choose custom maturity dates and notional amounts; however, unlike futures which trade on an exchange, they also create counterparty credit risk. This risk can of course be mitigated by the careful selection of counterparty banks and use of legal and credit documentation; an experienced currency overlay manager can be a helpful partner in this regard.

Once objectives and appropriate benchmarks are established, ongoing and consistent monitoring of the currency policy is key to its longevity and success. Assessing the performance difference between the portfolio and the benchmark is of course important; also important, however, is tracking their absolute performance, as this is what ultimately contributes to the investor’s portfolio and objectives as a whole.

Finally, periodic communication about the currency policy – including its objectives as well as its performance – will be important; not only can opinions about currency hedging differ across constituents, they can also change over time. Additionally, a regular program of education can be beneficial as market conditions, and how they relate to the investor’s currency policy, also change.
CHAPTER 1
Importance of having a currency policy
The decision to invest in foreign assets is often driven by the desire for better diversification or access to a broader set of investment opportunities. Although currency risk is an integral part of most forms of international investment, it is seldom the main reason for investment. When investors purchase the foreign currency needed to acquire a foreign asset, unless further action is taken, the investor has incurred currency risk from that point onward. Investors know they can then mitigate foreign exchange (FX) risk through hedging, but since hedging is often seen as separate from foreign investment, it requires deliberate action on their part and therefore needs to be justified, approved and measured – like other major investment decisions. Currency considerations are an integral part of foreign investments, and ideally investors should form their currency policies as a pre-condition to investing in foreign assets.

Prior to undertaking the effort to hedge, it’s worth examining just how important currency risk is. One way to gauge the significance of currency risk is to compare the risk of holding an international asset class on an unhedged basis versus a fully hedged or local currency basis, as in Table 01.

Table 01 shows that hedging reduces volatility and drawdowns regardless of asset class. For example, for an investor

<table>
<thead>
<tr>
<th>PANEL A: STANDARD DEVIATION</th>
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<td>Global ex-US equities</td>
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<td>Global ex-US bonds</td>
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<tr>
<td>EM equities</td>
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<tr>
<td>EM bonds</td>
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</tbody>
</table>

Data are annualized standard deviation of monthly returns.
*Global ex-US developed equities and bonds are fully hedged data; EM are local currency due to data availability, as local currency volatility is very close to fully hedged volatility.

Sources: First Quadrant, L.P., Datastream
with global ex-US developed equities, an unhedged position adds 2.6% to volatility compared to a fully hedged position, an 18% increase over this time period. With global ex-US developed bonds, the increase in volatility is dramatic. Currency risk dominates, adding almost 6% to the volatility and more than doubling the risk compared to a fully hedged position. Unhedged emerging market equities are riskier than EM equities in local currency. The volatility of EM bonds is almost entirely due to currency exposure.

Not only can currency risk be a significant portion of risk at the asset class level, it can also have a meaningful impact within a diversified portfolio. We created a simplified portfolio of 60% global developed equities and 40% US bonds, with the equities divided into US and global ex-US components. The weight of global ex-US equities was varied from 30% of the portfolio weight (i.e., half of total equities, or roughly what it would be in a global market capitalization weighted index) down to 10%. This is shown in Figure 01.

An investor with a 30% allocation to global ex-US equities would reduce total portfolio risk from 9.7% to 9.0% by hedging away currency risk. To put this in context, this is equivalent to a 7% shift from stocks to bonds. In other words, if 9.7% is the right amount of total portfolio risk, that level could be obtained either from a portfolio with 30% foreign equities unhedged/30% US equities/40% bonds or 33.5% foreign equities hedged/33.5% US equities/33% bonds. That’s a meaningful difference. Put more broadly, the risk reduction provided by

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**FIGURE 01 - RISK REDUCTION FROM HEDGING AS A FUNCTION OF FOREIGN EQUITY ALLOCATION**
(JANUARY 1980 - DECEMBER 2016)

Source: First Quadrant, L.P., Datastream
Currency Hedging Handbook

Chapter 1

Currency Hedging Handbook

Currency hedging allows the investor to reallocate the risk to higher-returning assets, which can aid in meeting overall investment objectives.

The data show that currency risk is significant for most globally diversified investors, but what should be done about it? There is a compelling case for investors to formulate and adopt a currency policy, which is a summary of the analysis and reasoning regarding a fund’s currency management. It may or may not entail a commitment to hedge, but should include two main parts. The first is establishing the strategic hedge ratio, i.e., the hedge ratio that, if applied on a static basis, does the best job of meeting long-term investment objectives. The strategic hedge ratio is the fund’s internal currency benchmark. It may be viewed as the currency version of strategic asset allocation. Absent a tactical view on currency, the fund would hold the strategic hedge ratio. The strategic hedge ratio is typically between 0% (unhedged) and 100% (fully hedged). It may – and probably does – differ for each international asset class, a topic we address in the next chapter. The second part of the currency policy is whether to manage currency exposure actively or passively. This is analogous to the active/passive discussion for stocks and bonds, and should be addressed with the same degree of rigor. Another consideration, if any sort of currency hedging, active or passive, is contemplated, is whether the hedging will be undertaken by internal or external resources. This issue may also be included in a fund’s currency policy.

Much of the reason for tackling these issues and bundling them into something we’re calling a currency policy is due to the potential challenges of governance. Currency has a significant impact on the risk profile of most globally invested portfolios, and merits the same degree of attention as other major investment policy questions. Some funds require major investment policy decisions to be approved by a board or committee; other funds are less formal. Adopting a sound and rigorously vetted currency policy promotes consistency through changes in fund personnel and during periods when short-term performance is disappointing.

If a fund lacks a currency policy, every time there is a currency performance surprise – especially when it’s a negative one – the fund will be vulnerable to questions about its currency exposure. There may be pressure to reverse whatever FX positions the fund currently has (i.e., switching from unhedged to fully hedged, or vice versa – and often just at the wrong time), incurring transaction costs and sowing confusion. Second-guessing can be avoided by having an established currency policy, which imposes discipline on both the philosophy and process.

The assumptions underlying the currency policy should be re-examined periodically, at the same frequency and perhaps the same time as the fund revisits its strategic asset allocation.

Why now?
Why should currency policy be a priority now? Investors have generally been
increasing allocations to international investment over the past several decades. The reasons for increased international investment are myriad, including better diversification, a broader set of investment opportunities and increasing investor comfort with foreign markets. The impact, however, is the same – an increase in currency risk.

Another consideration is currency volatility. Figure 02 shows rolling 36-month FX volatility for an investor exposed to the currencies of a global ex-US developed equity portfolio. Recently, volatility has been rising from levels that were low by historical standards. As of the end of December 2016, 36-month FX volatility, at 6.4%, is below the 36-year average of 8.4%, so there is scope for further increases.

There are also fundamental reasons why currency risk may increase. Global economic policy uncertainty has been rising, as shown in Figure 03 (next page). In the US for example, the new administration has suggested fiscal and trade policies that would represent a large departure from those of the previous administration. Even without policy specifics, the currency market has reacted sharply. It is likely that, as policy proposals are debated, there will be further currency volatility.

Other assets will also be affected by changes in government policy, but there is reason to think the currency markets will be more affected than most because much of the policy discussion is directed at globalization. Globalization affects trade and cross-border capital flows, among other

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**FIGURE 02 - ROLLING FX VOLATILITY TIME SERIES**
*(JANUARY 1980 - DECEMBER 2016)*

FX volatility is defined as the volatility of returns for global ex-US equities unhedged minus fully hedged.

Sources: First Quadrant, L.P., Datastream
things, and these are directly connected to the foreign exchange markets.

We would posit one more reason for taking a close look at currency risk at this time. *With the expected returns of major asset classes quite low by historical standards, investors should be motivated to use their risk budgets as efficiently as possible.* If a fund has more currency risk than indicated by its strategic hedge ratio, that risk can be redeployed into other investments that are more likely to provide incremental returns.
Establishing a currency policy benchmark: the optimal strategic hedge ratio

In this chapter, we show how to derive the optimal strategic hedge ratio. We undertake the analysis for each international asset class separately because they have very different volatilities and correlations to foreign currency. To determine the “optimal” strategic hedge ratio, we assume that investors wish to maximize expected risk-adjusted returns, and employ a multi-dimensional view of risk, incorporating standard deviation of returns and maximum drawdown.

We derive the optimal strategic hedge ratio using the same technique used for building efficient portfolios that maximizes expected risk-adjusted return. The required inputs are forecasts of returns, risks and correlation for foreign currency and the underlying asset. We construct a template for the analysis with global ex-US developed equity. The same template is then also applied to global ex-US developed sovereign bonds. For conciseness, we will henceforth drop the term ‘developed’ when referring to global ex-US developed equities and bonds.

Global ex-US equities

Returns

A fundamental tenet of investment is that investors expose themselves to risk with the expectation that they will generate returns. Investors demand a reasonable return from every risk, and they should avoid any uncompensated risks. Finance provides compelling justifications for expecting positive long-term returns from, for example, bonds (time value of money and the term premium) and stocks (equity risk premium), but this is not the case for developed market currencies. To be clear, here we are referring to the return for bearing pure currency exposure, excluding the return from any underlying asset. An example is a US investor holding non-interest bearing Japanese yen notes in a vault.

Exchange rate fluctuations are often driven by economic fundamentals such as country to country differences in inflation rates, productivity growth, trade and capital flows and investor behavior. Exchange rate movements of this sort may last a long time, but they are not permanent. They can stop or go into reverse as economies evolve. To profit from such currency movements would not be automatic; it would require analysis and good judgment, which are the ingredients of skilled active management. Passive currency exposure on its own cannot be expected to generate a positive (or negative) long-term return, but it clearly generates risk.
FX hedging using forward FX contracts
For those less familiar with forward FX contracts, we provide a brief, simplified discussion here. Forward FX contracts are contracts between two parties that oblige them to exchange an agreed amount of one currency for another currency on a fixed date in the future at a forward exchange rate that is specified at the contract’s inception. For example, if a US dollar investor wishes to hedge the currency exposure of a Japanese yen asset for 3 months, the investor would find a counterparty, usually a bank, that is willing to enter into a forward FX contract. The investor would agree to sell a fixed amount of yen (typically equal to the current value of the asset) to the bank in exchange for a fixed amount of dollars in 3 months from the opening date of the contract. In 3 months, the investor would be required to deliver the agreed amount of yen to the bank, and would in exchange receive from the bank the agreed amount of dollars. This exchange would close, or settle, the contract.

The forward FX rate used in the contract is determined by the current exchange rate, or spot rate, and the difference in the interest rates of the two currencies. The latter quantity, also known as the interest rate differential, or carry, is the return that currency hedgers receive or pay. If the foreign currency being hedged has a lower interest rate than the base currency, the hedger will receive the interest rate differential. If the foreign currency has a higher interest rate, the hedger will pay the interest rate differential. Foreign exchange traders refer to the difference between the spot and forward rate as forward ‘points’; i.e., the amount added to or subtracted from the spot rate prevailing at the time of the trade.

This contract acts as a hedge of the US dollar value of the investor’s yen assets because the investor has contracted with the bank to receive, in 3 months, a fixed amount of dollars. Regardless of whether the yen rises or falls against the dollar during the 3-month term, the amount of dollars the investor will receive has been fixed by the forward exchange rate agreed at the opening of the contract. (The value of the yen asset will probably fluctuate in yen terms over 3 months, so forward FX acts as an approximate hedge, although frequent adjustments to the amount hedged would reduce this slippage.)

In practice, investors hedging the currency of long-lived assets such as stocks usually avoid exchanging the full face value of the forward FX contract at the time the contract settles because this might entail large cash flows which the fund may not have in a conveniently liquid form, and which incur transaction costs. Instead, funds will transact only for the net amount they gained or lost over the life, or tenor, of the contract. They can do this by entering into a second forward FX contract that in effect rolls the hedge forward for another 3 months (also known as a swap) or, less frequently, transacting in instruments called non-deliverable forwards (commonplace in emerging markets; less so in developed markets). Contracts can be rolled for as long as the hedge is needed.
movements would not be automatic; it would require analysis and good judgment, which are the ingredients of skilled active management. Passive currency exposure on its own cannot be expected to generate a positive (or negative) long-term return, but it clearly generates risk.

A simple thought experiment reveals why this is so. Return to the example given above of a US investor holding non-interest bearing Japanese yen notes in a vault. Now consider the example of a Japanese yen investor holding non-interest bearing US dollar notes in a vault. At any given point in time, one of these investors will have a gain and the other a loss from their respective currency positions. They both cannot rationally expect a positive return, unconditionally, from their holdings, no matter how long they hold their foreign currencies.

What do the data reveal about long-term currency returns? Continuing with the example of global ex-US equity, Figure 04 isolates the impact of currency hedging on returns by comparing global ex-US equity unhedged returns to fully hedged returns, as we did when comparing risks in Table 01 at the beginning of this chapter. For the sake of brevity, we will refer to this difference as the ‘currency effect’. All of the examples in the handbook that refer to currency hedging use forward foreign exchange contracts with a 3-month tenor, unless otherwise stated (see text box on page 15 for a description of forward FX contracts). From January 1980 to December 2016, the global ex-US equity unhedged return was 10% per annum compared to 9.5% fully hedged. The unhedged return exceeded the fully hedged return by 0.5% per annum, but the
difference is highly dependent on the starting and ending points, and should not be interpreted as a return expectation.

**Risks**
This section develops the forecast for currency risk used as an input for determining the strategic hedge ratio. We assess whether the fundamental drivers of risk have changed over time. If this were the case, then historical measures of risk, summarized in Table 02 on the following page, should be adjusted for this forward-looking application. We also check to see if investors with different time horizons should hedge currency risk differently.

**Globalization**
The risk of currency exposure and hedging may be affected by globalization. Some investors argue that because companies have become more global over time, there is less reason to hedge their equity. Multinationals conduct business in many currencies, including possibly the investor’s base currency. Markets should reflect this in the returns of multinational companies, the argument goes, reducing the necessity of hedging. What matters for US dollar investors, in this debate, is how much US dollar business a foreign company does, not how much global business it does. Global multinationals tend to have a certain percentage of their business in dollars, but they are also apt to do business in Europe and Asia-Pacific. A further complicating factor is that a multinational may be hedging some of its own foreign currency exposures, which would make it behave more like a domestic company in FX terms.

It can be difficult to obtain timely, accurate data on a company’s underlying exposure to specific foreign currencies. Without access to clean fundamental data on the amount of business foreign companies conduct in US dollars, we looked at statistical relationships to see what they reveal about trends in US dollarization of non-US developed companies. We looked at the relationship between movements in the US dollar and growth of foreign company earnings and stock prices, both measured in local currency. If foreign companies have been doing proportionately more business in dollars, then their earnings measured in local currency should become increasingly sensitive to the dollar. According to our analysis, we didn’t find this to be the case. Aside from earnings, we looked directly at foreign stock prices (in local currency) to see if they had become more sensitive to fluctuations of the dollar over time. Again, we found little evidence of this.

**Time horizon**
What happens to currency risk when it’s measured over different time horizons? Table 01 presented risk as the annualized standard deviation of monthly returns and 12-month downside risk, but most investors have longer horizons. Table 02 on the next page compares standard deviation of returns for global ex-US equities over three time horizons: 1-month, 5-year and 10-year, from January 1980 to December
2016. Data are annualized to facilitate comparison over the three time horizons.

We find that unhedged equities are riskier than fully hedged equities over all three horizons, but the difference shrinks from 2.6% p.a. using monthly returns to 1.6% p.a. at 5 years and 1.2% p.a. at 10 years. **Equity risk also shrinks as the time horizon extends, though incremental currency risk as a proportion of equity risk remains roughly constant at around one fifth, which is significant.** We would posit that perceptions of risk are subjective, and most investors who consider themselves to have long time horizons still care about intermediate returns.

Figure 02 (page 12) showed rolling 36-month volatility for a US dollar investor exposed to the currency basket of a global ex-US equity portfolio. We see no evidence of a structural shift in currency risk for US dollar base investors despite the lower-than-average levels we have seen recently and, as this is a strategic benchmark, we are inclined to use the historical monthly average volatility of 8.4%.

**Correlations**
The third input is the correlation between the foreign currency return and the return to global ex-US equity fully hedged. We have argued above that currency exposure does not, on its own, warrant an expected return, but it’s conceivable that currency return patterns could be sufficiently diversifying to reduce the risk of global ex-US equity returns (translated into the investor’s base currency). One of the reasons investors sometimes offer for not hedging is that they believe currency to be diversifying. **If FX were diversifying, currency exposure would reduce the risk of foreign assets measured in US dollars, but we already know from Table 01 that it can increase the risk of foreign assets.**

Before we look at the data on correlation, might there be fundamental drivers that influence the correlation? If foreign currencies are weak and the US dollar strong, that would tend to increase the local currency earnings of foreign companies that conduct some of their business in US

<table>
<thead>
<tr>
<th>TABLE 02 - FX VOLATILITY FOR DIFFERENT HOLDING PERIODS (US DOLLAR BASE CURRENCY GLOBAL EX-US EQUITY PORTFOLIO) (JANUARY 1980 - DECEMBER 2016)</th>
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</thead>
<tbody>
<tr>
<td><strong>Standard Deviation of Returns, Annualized</strong></td>
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<tr>
<td>Unhedged</td>
</tr>
<tr>
<td>Fully hedged</td>
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<tr>
<td>Unhedged minus fully hedged</td>
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<tr>
<td>FX risk as % of fully hedged risk</td>
</tr>
<tr>
<td>Currency effect*</td>
</tr>
</tbody>
</table>

*Currency effect is the return of global ex-US equities unhedged minus global ex-US equities fully hedged

Sources: First Quadrant, L.P., Datastream
dollars for two main reasons (assuming all else equal). First, to the extent that foreign companies generate profits in US dollars, the local currency value of those dollars will be greater. Second, if foreign companies price their products in their home currency, the US dollar price of their products will decline, potentially leading to greater demand from US dollar customers and higher sales volumes. The same influences would work in reverse when foreign currencies are strong and the dollar weak. This relationship could give rise to a negative correlation between foreign currency and foreign equity, which would indeed be diversifying. We seldom observe it in the data, however, in part because all else isn’t equal.

For example, sometimes a macro event such as disappointing GDP growth prospects affects the local equity market negatively and at the same time reduces the attractiveness of the market for foreign investors. This could lead to a positive relationship between foreign currency and foreign equity. Also, as mentioned earlier, multinational companies located outside the US conduct business in US dollars and in many other currencies as well. The US dollar may not be the dominant foreign currency relationship.

A handful of currencies have been called ‘safe haven’ currencies because it is thought that those currencies will perform better than others during bad times in markets and economies. This may be because the countries with the safe haven designation are viewed as open to foreign capital flows, having prudent macroeconomic policies and being less vulnerable to a global economic

**FIGURE 05 - ROLLING FX CORRELATION WITH GLOBAL EX-US EQUITIES FULLY HEDGED**

(December 1982 - December 2016)

Sources: First Quadrant, L.P., Datastream
downturn or global inflationary surge. The currencies identified as safe havens shift over time, and safe haven status depends on an investor’s base currency. The Swiss franc and Japanese yen are sometimes considered safe haven currencies. We mention safe haven currencies because, if the US dollar acted like one, then foreign currencies would tend to depreciate against the US dollar at the same time as foreign equities were weak, resulting in more positive correlations. That was the case in the recent financial crisis, but the pattern is hardly consistent over time. During the dot-com bubble of the late 1990s to early 2000s, for example, the correlation between foreign currency and foreign equities was negative.

In searching for a fundamental explanation for correlation, the arguments go in both directions for US dollar investors, and this is borne out in the data, where there is little evidence of consistent correlations. Figure 05 on the previous page shows the rolling 36-month correlation of FX with global ex-US equity fully hedged. The correlation will be positive when foreign currencies move in the same direction as foreign equities (fully hedged), and negative when they move in opposite directions. The average correlation over the full period is an insignificant 0.05, although there are periods when the correlation is materially positive (around 0.3 or more) and negative (-0.3 or less). Thus we assume a correlation of zero for US dollar investors.

Figure 06 builds on Figure 05 by adding a second data series that is the difference in risk (standard deviation) between global ex-US equity unhedged and fully hedged. Table 01 showed that, on average, the risk of
unhedged equity exceeds the fully hedged risk by 2.6%. Yet there are a few periods when the unhedged risk of global ex-US equity is slightly lower than fully hedged, and Figure 06 shows that these periods are driven by sharply negative correlations between currency and fully hedged equity. In fully 87% of 36-month periods, however, the risk of the fully hedged position is lower than the unhedged position, which argues strongly for some degree of hedging.

**Results**

Table 03 shows the historical data used for the inputs (except for correlation, assumed to be zero, as discussed earlier).

The result is that a strategic hedge ratio of right around 75% is optimal for US investors with global ex-US equities whose objective is to maximize return/risk.

**Table 03 - Inputs for Strategic Hedge Ratio**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected return of FX exposure</td>
<td>0.5%</td>
</tr>
<tr>
<td>Expected volatility of FX exposure</td>
<td>8.4%</td>
</tr>
<tr>
<td>Expected volatility of global ex-US equity, fully hedged</td>
<td>14.6%</td>
</tr>
<tr>
<td>Expected correlation between FX and equity</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Sources: First Quadrant, L.P., Datastream

The exact result from the inputs in Table 03 is 74%, but note that there can be some variability in the inputs by changes in the date range or methodology. The result remains in the region of 75% under most conditions, however. Figure 07 shows historical returns, risks and return/risk as the strategic hedge ratio is varied from 0% to
The peak improvement in return/risk is indeed attained for hedge ratios between 70% and 80%. The 50% hedge ratio has 80% of the potential improvement in return/risk. A 100% hedge ratio is slightly less optimal than a 75% hedge ratio.\textsuperscript{13}

Table 04 summarizes the pros and cons of four different hedge ratios commonly used by investors. It’s worth mentioning the 50% hedge ratio. One of its properties is that, because it’s half way between the two endpoints of 0% and 100% hedged, it is said to minimize the `regret’ that some investors experience over the course of an up-and-down currency cycle. When an investor is unhedged, and foreign currencies depreciate substantially, with the benefit of hindsight, they may wish they had a 100% hedge. On the other hand, if an investor is fully hedged, and foreign currencies appreciate, they may wish they had instead been unhedged. A 50% hedge gives investors half the gain of any foreign currency appreciation or half the loss of any depreciation. It’s a compromise that also provides most of the return/risk benefits of the optimal strategic hedge ratio.

One simplification we’ve employed in this analysis is to assume investors use the same hedge ratio for each of the currencies in global ex-US equity. An extension could be to undertake this analysis separately for each currency, so that instead of a single strategic hedge ratio there would be as many different hedge ratios as there are foreign currency exposures. In our view, such an approach, while not necessarily unreasonable, is closer in spirit to active management than the benchmarking exercise we are carrying out here.

The focus here is on the US dollar investor, but it is instructive to see how a strategic hedge ratio of 75% compares to the strategic hedge ratio for investors with different base currencies. Is a 75% hedge ratio an outlier, or are US dollar base investors members of a broader community of global investors who would

<table>
<thead>
<tr>
<th>Hedge ratio</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>No transaction costs or hedging infrastructure needed</td>
<td>Uncompensated risk; higher drawdowns</td>
</tr>
<tr>
<td>50%</td>
<td>80% of the improvement in return/risk; minimizes regret</td>
<td>Transactions costs; hedging infrastructure needed</td>
</tr>
<tr>
<td>75%</td>
<td>Optimal: maximizes return/risk; somewhat lower drawdowns</td>
<td>Transactions costs; hedging infrastructure needed; requires MPT methodology</td>
</tr>
<tr>
<td>100%</td>
<td>Close to optimal; minimizes risk; lower drawdowns</td>
<td>Transactions costs; hedging infrastructure needed</td>
</tr>
</tbody>
</table>

TABLE 04 - PROS AND CONS OF DIFFERENT HEDGE RATIOS
TABLE 05 - STRATEGIC HEDGE RATIOS FOR INVESTORS IN GLOBAL EQUITIES, BY BASE CURRENCY

<table>
<thead>
<tr>
<th>Currency</th>
<th>Optimal (Historical correlation)</th>
<th>Optimal (Zero correlation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUS</td>
<td>66%</td>
<td>111%</td>
</tr>
<tr>
<td>CAN</td>
<td>37%</td>
<td>102%</td>
</tr>
<tr>
<td>DEN</td>
<td>114%</td>
<td>121%</td>
</tr>
<tr>
<td>EMU</td>
<td>64%</td>
<td>69%</td>
</tr>
<tr>
<td>HKG</td>
<td>67%</td>
<td>51%</td>
</tr>
<tr>
<td>JPN</td>
<td>100%</td>
<td>84%</td>
</tr>
<tr>
<td>NWY</td>
<td>88%</td>
<td>121%</td>
</tr>
<tr>
<td>NWZ</td>
<td>101%</td>
<td>152%</td>
</tr>
<tr>
<td>SNG</td>
<td>-10%</td>
<td>67%</td>
</tr>
<tr>
<td>SWD</td>
<td>43%</td>
<td>75%</td>
</tr>
<tr>
<td>SWI</td>
<td>84%</td>
<td>68%</td>
</tr>
<tr>
<td>UK</td>
<td>79%</td>
<td>95%</td>
</tr>
<tr>
<td>USA</td>
<td>82%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Sources: First Quadrant, L.P., Datastream

be better off hedging a substantial portion of the currency exposure of their foreign equities? Table 05 uses the same analysis as above, but from the perspective of a selection of different developed market base currencies. In each case, investors have the same objective of maximizing expected risk-adjusted returns of the currency exposure of their global ex-base currency equities. The exhibit has three columns. The first is the investor’s base currency. The second column is the optimal strategic hedge ratio using the historical correlation between foreign currency returns and fully hedged foreign equity, and the third column is the same as the second except we used a correlation of zero instead of the historical one. Whether to use the historical correlation or a zero correlation depends on whether you believe there is a fundamental basis for the historical correlation, or if it may be distorted by special factors or is simply noise and should be ignored. In the case of the US dollar base, we believe zero is the right answer because we don’t find a sufficiently strong fundamental case to use the historical correlation, and the correlation is quite close to zero in any case.

As shown in the table, the US dollar strategic hedge ratio is not an outlier. Most other base currencies also have hedge ratios between 50% and 100%. When you work through the math, given the inputs of volatility, correlation and return, several base currencies have theoretically optimal strategic hedge ratios greater than 100%, but in practice few investors would be inclined to hold a strategic hedge ratio greater than 100%.

For the safe haven Swiss franc and Japanese yen, the optimal hedge ratios using their historically positive correlations are 16% higher than if the correlation is assumed to be zero, a modest difference.

Several currencies exhibit the opposite behavior, where the correlation between
foreign currency and foreign equities tends to be negative, so the optimal hedge ratio using the historical correlation is lower than if the correlation were assumed to be zero. For most of these base currencies, some foreign currency exposure is diversifying. For some of these countries – notably Australia, Canada, New Zealand and Norway – commodity exports are an important part of their economy. During global economic downturns, commodity prices are often weak, putting downward pressure on the currencies of commodity exporters. Investors in commodity-exporting countries experience base currency weakness when global equities are weak, reducing – though not eliminating – the benefits of currency hedging. For Canadian dollar base investors, the optimal hedge ratio is a relatively low 37%, although for the other three commodity exporters, the optimal hedge ratio ranges from 66% to 101%.

Returning to the earlier discussion on how time horizon affects risk, we repeated the analysis using multi-year inputs. This assumes that investors are indifferent to short- and medium-term currency risk and only care about returns at the end of the holding period. When the results are assessed for rolling periods varying from 2 to 20 years, the average optimal hedge ratio was about 50%.

**Drawdowns**

The optimal strategic hedge ratio of 75% was derived using standard deviation as the measure of risk, but for some investors drawdown is a more pertinent measure of risk. Would switching the risk measure to drawdown change the optimal strategic hedge ratio? If the concern is mitigating the

**FIGURE 08 - OPTIMAL HEDGE RATIOS FOR DIFFERENT OBJECTIVES**

(JANUARY 1980 - DECEMBER 2016)

Sources: First Quadrant, L.P., Datastream
worst peak-to-trough drawdown, then the most effective hedge ratio would have been 100% (fully hedged), based on the historical data. If the concern is mitigating the mean peak-to-trough drawdown, then 70% would have been optimal – quite close to the 75% figure. A 70% hedge ratio would also be optimal if the objective is to minimize the worst one-month drawdown. **Thus, based on the analysis, the 75% strategic hedge ratio is not only the best answer for maximizing the Sharpe ratio, but also quite close to optimal for mitigating mean or worst one-month drawdown risk.** Figure 08 on the previous page summarizes the optimal hedge ratios for these objectives.

**Global ex-US bonds**

We repeat the exercise for US dollar investors holding global ex-US sovereign bonds. The conceptual framework and assumptions we set out above also largely apply to bonds. The inputs, however, are quite different. Table 01 showed that currency volatility dominates the risk profile of global ex-US bonds. Currency volatility, on its own, is almost double the volatility of global ex-US bonds fully hedged. An investment in global ex-US bonds unhedged is effectively an investment in a basket of foreign currencies, which means a large increase in risk with no incremental expected return.

The correlation of monthly returns between foreign currency and global ex-US bonds fully hedged is 0.6. Foreign currency exposure, far from diversifying global ex-US bonds, adds additional risk. The significant positive correlation may indicate that currency investors and global bond investors:

![FIGURE 09 - ROLLING 36-MONTH FX CORRELATION AND UNHEDGED MINUS FULLY HEDGED BOND VOLATILITY (JANUARY 1980 - DECEMBER 2016)](image-url)
investors are looking for similar underlying economic conditions when they invest.

Figure 09 on the previous page shows the 36-month rolling correlation and the difference in volatility between unhedged and fully hedged global ex-US bonds. While there were a few periods when the correlation was significantly negative, because currency is so much more volatile than the hedged asset, the volatility of the unhedged bonds is always substantially higher than the volatility of the fully hedged bonds.

The strategic hedge ratio for global ex-US bonds is 98% if one believes the correlation between foreign currency and fully hedged bonds is zero, or 110% if one believes the 0.6 correlation is meaningful. Either way, a reasonable strategic hedge ratio would be 100%.

Table 06 compares the foreign bond strategic hedge ratio for investors with different base currencies. The hedge ratios are all fairly close to 100%. The US dollar investor is not a special case with respect to hedging the currency exposure of bonds.

**Emerging markets**

We use the same framework to assess the currency exposure of emerging market equities and bonds, but the inputs differ from those used for developed market equities and bonds, leading to very different conclusions. A greater proportion of the risk of emerging markets comes from country-level macroeconomic and political factors compared to developed markets. Because currency markets reflect macroeconomic and political risks, much of the reason for investing in emerging markets is transmitted by the currency markets. Hedging away emerging market currencies would remove a large portion of the emerging market characteristics that are a primary reason for investing in those markets in the first place.

The macroeconomic and political risks of emerging market currencies are reflected in the riskiness of the exchange rates and in the high interest rates of many of those currencies. Hedging high interest rate currencies is expensive, and would reduce substantially the expected return

**TABLE 06 - STRATEGIC HEDGE RATIOS FOR INVESTORS IN GLOBAL BONDS, EXCLUDING BASE CURRENCY**

<table>
<thead>
<tr>
<th>Investor base currency</th>
<th>Optimal (Historical correlation)</th>
<th>Optimal (Zero correlation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>109%</td>
<td>104%</td>
</tr>
<tr>
<td>Canada</td>
<td>113%</td>
<td>103%</td>
</tr>
<tr>
<td>Denmark</td>
<td>99%</td>
<td>109%</td>
</tr>
<tr>
<td>Euro area</td>
<td>89%</td>
<td>95%</td>
</tr>
<tr>
<td>Japan</td>
<td>87%</td>
<td>96%</td>
</tr>
<tr>
<td>Norway</td>
<td>106%</td>
<td>107%</td>
</tr>
<tr>
<td>New Zealand</td>
<td>108%</td>
<td>106%</td>
</tr>
<tr>
<td>Sweden</td>
<td>98%</td>
<td>96%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>85%</td>
<td>95%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>100%</td>
<td>101%</td>
</tr>
<tr>
<td>US</td>
<td>110%</td>
<td>98%</td>
</tr>
</tbody>
</table>

Sources: First Quadrant, L.P., Datastream
from emerging market investment. Our research has shown that hedging away EM currency risk from EM equity and bond indices essentially provides (expensive) developed equity and bond exposures, respectively, while retaining very little EM-specific exposure.\textsuperscript{15}

Table 07 summarizes the strategic hedge ratios derived in Chapter 03.

\begin{table}[ht]
\centering
\begin{tabular}{lcc}
\hline
 & Equities & Bonds \\
\hline
Developed markets & 75\% & 100\% \\
Emerging markets & 0\% & 0\% \\
\hline
\end{tabular}
\caption{Strategic Hedge Ratio Matrix for US Dollar Base Currency Investors}
\end{table}

\textbf{Hedging other types of investments}

A currency policy should cover all foreign assets, including illiquid and alternative assets, and the framework presented here can be extended to these investments. The required inputs are the same: estimates of expected return, risk and correlation to foreign currency. Because holdings in alternative asset classes vary substantially from one investor to another, it is more difficult to generalize about their expected return, risk and correlation than for the traditional classes analyzed above, and therefore more difficult to supply an optimal currency hedge ratio.

For example, within hedge fund allocations, the weights of specific types of hedge funds vary widely across investors. Some investors will have a higher weighting of equity long/short funds while others may emphasize fixed-income arbitrage. The optimal currency hedging treatment of these two types of hedge funds is quite different.

Without knowing, at a minimum, the weights of the different types of funds within an investor’s hedge fund allocation, it would be pure speculation to supply an optimal currency hedging ratio for a hedge fund allocation.\textsuperscript{16} For alternative assets, one size rarely fits all.
Active/passive management
Having established the strategic hedge ratio, investors must decide whether to implement their currency policy actively or passively. They should approach this question for currency in the same way as for equities, bonds and other types of investments. Active currency management offers the same benefits as active management in other assets: a potential source of incremental, diversifying return that improves a portfolio’s return/risk. It also carries the same risk of underperformance while incurring management fees.

While investors have their own methods for deciding whether to manage actively or passively, the basic template usually covers these questions: 1) Does the investor believe the asset class offers ways to add value consistently? 2) Can skilled managers with sufficient capacity be identified in advance?

This section is arranged as follows. We start with a discussion of participants in the currency market because this is related to the potential for adding value. Then we review types of active currency management, followed by an examination of the track record of the universe of currency managers. The next section is about constraints on active currency mandates. We conclude with a discussion of the costs of passive hedging and active management.

Participants in the foreign currency market
Investors in stocks and bonds are usually interested in maximizing the return (or risk-adjusted return) from their holdings, but this is not the case for many participants in the currency market. Currency is a medium of exchange, and a large number of currency transactions are driven by an immediate need to consume goods or services denominated in a foreign currency. This kind of trade is driven by a combination of price, quality and convenience of the goods and services involved. While the valuation of a foreign currency is one input, it isn’t the only factor that determines which goods and services are consumed.

Another example of a participant whose main motivation is not necessarily profit maximization is a central bank. Central banks use currency transactions as one tool for implementing macroeconomic policies. They may be willing to be on the losing side of a transaction if it furthers their wider policy objectives.

Figure 10 on the next page shows the main categories of currency participants and how much of the market each represents. Currency managers and portfolio flows (driven by investors) account for only 13% of the market. These are the participants most concerned about maximizing value from their foreign currency exposure. Mergers and acquisitions and foreign direct investment account for another 4%. Currency matters for these long-term investors, but is often a secondary consideration.

Trade flows, central banks and tourism are less driven by currency values. The remaining participant, the largest, is
corporate treasury, whose currency transactions cover a range of activities including financing, intra-company transfers and hedging.

The Efficient Market Hypothesis (EMH), which says that asset prices reflect all available information, offers a plausible conceptual explanation for why active managers in stocks and bonds sometimes struggle to outperform their benchmarks. It would seem, however, that the EMH might not apply to the same extent in currency, where for so many of the participants currency is not the main concern, but merely the means to an end. While this might imply that currency markets are prone to exploitable inefficiencies, we would not suggest that currency managers have an easy task.

For one thing, the critical importance of currency markets to the real economy means that currency is among the most susceptible of the financial markets to politically motivated intervention. This adds to both the challenges and opportunities for active managers in this field.

**Types of active management**

This section describes the different types of active currency management. Managers sometimes combine more than one of these categories into a single product.

**Discretionary**

Discretionary currency managers use fundamental analysis, sometimes combined with technical analysis, to form views on specific exchange rates. They exercise discretion over which inputs are relevant to a particular exchange rate, and the choice of inputs may change over time as market conditions evolve. The forecasting horizon varies from short-term to long-term.

**Factor-based**

Currency researchers, like their counterparts in equities and fixed
income, have for many years analyzed the relationships between the fundamental characteristics, or factors, of a currency and its subsequent performance. Rigorous factor-based investors require that each factor they use has a fundamental economic rationale for why it might work.\textsuperscript{17} In currency markets, three factors have achieved elevated status: they have been known for many years and are supported by a large body of academic work; there are plausible reasons for why they work; they have worked in many time periods and in many currencies; and they are investible even for large investors. The three factors are value, carry and trend. Precise definitions for the factors differ among investors. The text box on the next page summarizes these factors. There are also many other potential factors beyond these three (see discussion of systematic fundamental managers below).

Factor investors implement their chosen factors systematically. The factors are transparent and straightforward to implement and there are many variations on how managers combine factors. They are sometimes called ‘smart beta’ strategies.

**Systematic fundamental**

Systematic fundamental management is an extension of the factor-based approach. This approach goes beyond value, carry and trend, employing a range of less well-known factors based on fundamental aspects of currency market and investor behavior. An advantage of using less well-known factors is that they are not as prone to commoditization as value, carry and trend. Commoditization occurs when a factor receives large inflows of investor money, driving down returns and reducing diversification benefits. A disadvantage of less well-known factors is that there is less academic research on them, so the underlying rationales may not be as well understood.

**Dynamic hedging**

Dynamic hedging is an approach to managing currency that has as its main objective mitigating downside risk, though it may also seek to add returns. It is a kind of portfolio insurance for currency exposure. Some versions use put options while others use the forward FX market dynamically to create option-like payoffs. A benefit of this approach is downside protection, but this comes at the cost of an explicit or implicit premium. The approach is implemented by reacting to currency moves and does not require currency forecasts. Whether the approach can add value depends on the nuances of the particular strategy and the behavior of currency markets. If the markets exhibit significant trend-like behavior, dynamic hedging may add value. A potential pitfall with versions of dynamic hedging that seek to replicate option-like behavior without actually using options is gap risk – the risk that markets move too rapidly for the strategy to respond effectively.

**Performance of currency managers**

Earlier in this chapter we showed that a sizeable fraction of currency market
Currency Factors in Brief

Value: One definition is purchasing power parity (PPP), which uses the law of one price to assess whether a particular currency is cheap or expensive compared to another. The strategy buys the inexpensive currency and sells the expensive currency. The rationale is that if a currency is deeply undervalued, consumers would switch to importing goods from that country and away from countries with similar goods but more expensive currencies. Eventually, the increase in demand for the inexpensive currency would raise its value.

Carry: The difference in interest rates between two currencies. The interest rate tenor may vary, but are often tenors of one year or less, which correspond to the tenors of typical forward FX contracts. The strategy buys the higher-yielding currency and sells the lower-yielding one. One rationale is that relatively high interest rates signal higher currency risk, and the interest rate differential is needed to entice investors to hold the riskier currency. While the higher-yielding currency may depreciate, historical depreciation has tended to be less than indicated by the interest rate differential, thus generating profits.

Trend: Also called momentum, and compares exchange rates based on their returns over short-term to medium-term time horizons. A twelve-month look-back period is often used. The strategy buys currencies that have been appreciating relatively strongly and sells ones that have been depreciating. A rationale is that exchange rate momentum reflects changes in underlying fundamentals, which some market participants respond to with a delay. As participants eventually become aware of the changing fundamentals, their market activity drives further appreciation (depreciation) of the currencies with fundamentals that are improving (deteriorating) on a relative basis.

participants are not primarily in the currency market in order to maximize the value of their currency exposure — other motives matter more. It’s conceivable that this creates inefficiencies in the currency market, although it is difficult to know with certainty. One piece of evidence, albeit indirect, is the track record of currency managers. This is one group of currency market participants who are motivated to maximize the value of the currency exposures they manage. If, as a group, they are able to add value consistently over time, it suggests that there are exploitable features of the currency market. If collectively they cannot add value, it could mean that the currency market is highly efficient, or that most managers are not sufficiently skilled to capitalize on the opportunities that are present.
What do the data show? Using a database of currency manager track records, we plotted aggregate manager performance for rolling 3-year periods from 2002 to 2016. The plots show the gross performance of the median manager in each 3-year period and the upper and lower quartile managers. Figure 11 shows this data for excess return over each manager’s respective benchmark, and Figure 12 (next page) for the information ratio.

Figure 11 shows that the median manager in every 3-year period generated a positive excess return gross of fees. Table 08 (next page) divides the same underlying data into 3 non-overlapping 5-year periods (2002-2006, 2007-2011 and 2012-2016). The median information ratio averaged 0.5 (gross) in those periods, and the lower quartile managers had an average IR of 0.2. This suggests that if investors had only a random ability to select currency managers, no better than throwing darts at a board, the average investor would outperform gross of fees in each 5-year period. Even if investors selected the lower quartile manager, they would have outperformed (gross) more often than not in each five-year period.

To put performance of the universe of currency managers in context, we compared it to a universe of global developed equity managers in Table 09 (page 34). The managers in the currency universe performed, on average, better than the managers in the global equity universe. The information ratios of the upper quartile, median and lower quartile currency managers were consistently higher than the information ratios for the global equity managers at the same
The track records suggest that if an investor is able to select currency managers as well as they can select global equity managers, the currency universe offers better opportunities for outperformance. Another way of interpreting the data is that if an investor is more skillful in choosing global equity managers than currency managers, the reward from active currency management may nevertheless be similar to that achieved from global equity managers. Over the 15-year period, for example, the performance quartiles in each of the 5-year periods.

**TABLE 08 - UNIVERSE OF CURRENCY MANAGERs, 5-YEAR TRACK RECORDS**

<table>
<thead>
<tr>
<th>Periods:</th>
<th>Jan 2002 to Dec 2006</th>
<th>Jan 2007 to Dec 2011</th>
<th>Jan 2012 to Dec 2016</th>
<th>Average of 3 periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess Returns % p.a.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Quartile</td>
<td>4.7%</td>
<td>3.8%</td>
<td>3.5%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Median</td>
<td>1.9%</td>
<td>1.2%</td>
<td>2.0%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Lower Quartile</td>
<td>0.3%</td>
<td>0.0%</td>
<td>0.8%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Information Ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Quartile</td>
<td>1.3</td>
<td>0.7</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Median</td>
<td>0.8</td>
<td>0.3</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Lower Quartile</td>
<td>0.4</td>
<td>0.0</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td># Managers</td>
<td>40</td>
<td>48</td>
<td>32</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: Mercer
information ratio of the upper quartile global equity manager was 0.6, which is slightly higher than the 0.5 information ratio of the median currency manager. The number of currency managers in this universe averaged about 40 over the time period, and 32 in the recent 5-year period. While the number is small compared to other types of investments – the same database has over 160 global equity strategies – capacity should not be an issue. This is because developed market currency is one of the most liquid financial markets in the world, with over US $5 trillion in daily volume.

Performance of currency factors
Another piece of evidence on opportunities to add value in currency is the performance of factor-based strategies. The results can be found in Figure 13 (next page). In addition to the three factors, we included an equal-weighted combination of them. Table 10 (next page) is a numerical summary of the same data.

The three factors all generated positive returns with information ratios ranging from 0.2 to 0.4 (excluding costs). Carry was the riskiest of the factors, especially in terms of downside risk. The 3-factor equally weighted combination performed well, with an information ratio of 0.6 and less downside risk than any individual factor. This study shows that naive strategies in the public domain added value, another indication that there is scope to add value in currencies. The live track records of managers and the performance of naive strategies are not entirely independent, however. Some managers use these factors as one of several inputs to their strategies. These two analyses taken together provide some evidence of the opportunities available for active currency managers.

<table>
<thead>
<tr>
<th>TABLE 09 - UNIVERSE OF GLOBAL EQUITY MANAGERS, 5-YEAR TRACK RECORDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periods:</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Excess Returns % p.a.</td>
</tr>
<tr>
<td>Upper Quartile</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Lower Quartile</td>
</tr>
<tr>
<td>Information Ratio</td>
</tr>
<tr>
<td>Upper Quartile</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Lower Quartile</td>
</tr>
<tr>
<td># Managers</td>
</tr>
<tr>
<td>Source: Mercer</td>
</tr>
</tbody>
</table>
Constraints on active hedging mandates

This section addresses potential currency exposure constraints on active currency mandates. Constraints are often imposed on active hedging mandates for risk management purposes. A few examples of potential constraints are:

- Limiting net exposure in each currency to some fixed percentage of the amount of underlying foreign assets denominated in that currency.\(^{21,22}\)
- Limiting expected tracking error versus the currency benchmark.
- Prohibiting the use of currencies that are not in the underlying assets.

There are many possible variations on these constraints. Because an investor’s base currency may go through extended
cycles of appreciation and depreciation, the interaction between these constraints and the strategic hedge ratio may have a significant impact on the medium-term performance of an active currency mandate. A crucial determinant of that impact is whether the position constraints are symmetrical around the strategic hedge ratio (or currency benchmark).

An example of an asymmetric constraint is when the strategic hedge ratio is 0% (unhedged) and the currency manager is limited to net currency exposures between 0% and 100%. In this case, if foreign currencies are going through a lengthy period of strength versus the base currency, it will be difficult for a manager to add value during such periods. The reason is that most of the time the manager attempts to hedge during periods of base currency weakness, the hedges will lose money.

During these periods, investors will be generating gains from the currency exposure of their underlying assets while their constrained currency manager may be underperforming relative to a 0% strategic hedge ratio. The combined return of currency exposure and the impact of the manager’s hedging may well be positive, but less than the gain of the currency exposure on its own.

The situation will be reversed in periods of base currency strength. Much of the manager’s hedging activity will be generating gains relative to a 0% hedge ratio. Including hedging gains, the investor will likely suffer an absolute loss from currency exposure during such periods.

With asymmetric constraints, the manager’s performance will be biased by the direction of the trend in the base currency. A proper evaluation of the manager would require a full currency cycle, which might take many years.

If net currency exposure is constrained between 0% and 100%, this would be symmetrical if used with a 50% strategic hedge ratio. In this situation, a manager would have equal opportunities to outperform or underperform during base currency strength or weakness. Table 11 summarizes the expected relationship between strategic hedge ratios, constraints and manager performance.

One function of position constraints is that they may bind the manager’s hedging activity to the underlying foreign asset

<table>
<thead>
<tr>
<th>Strategic Hedge Ratio</th>
<th>Performance bias of constrained active manager* during periods when base currency is:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Appreciating</td>
</tr>
<tr>
<td>75%</td>
<td>Underperform</td>
</tr>
<tr>
<td>100%</td>
<td>Underperform</td>
</tr>
<tr>
<td>50%</td>
<td>None</td>
</tr>
<tr>
<td>0%</td>
<td>Outperform</td>
</tr>
</tbody>
</table>

*Constrained to exposure range 0%-100%
exposures. The first and third sample constraints at the beginning of this section have this effect. Mandates for currency hedging are often constrained in this way, but they don’t have to be. Constraints can be much looser and untethered to underlying currency exposures.

For a skilled manager, loosening constraints tends to improve risk-adjusted performance.

Costs

Currency hedging, passive or active, incurs several kinds of costs:

- Transaction costs
- Management fees (active) or implementation costs (passive)
- Monitoring / oversight costs
- FX prime broker fees (optional)

Transaction costs are incurred when trading instruments used for currency hedging, and also if it’s necessary to buy or sell portfolio assets to meet the liquidity demands of the hedging program. Transaction costs depend on market conditions, the amounts traded, the method used for trading, as well as the types of instruments [discussed in Chapter 4] and which currencies are being traded. There are no explicit per-trade costs or fees, however, with the possible exception of prime broker fees in some cases.

Two kinds of trades are common with forward FX contracts: 1) trades that change the amounts being hedged, and 2) trades that roll existing hedges forward to a future date. In developed market currencies, both kinds of trades are quite inexpensive given the size and liquidity of the market. The first kind of trade, which we’ll call ‘spot’ trades for convenience, can be more expensive than the second because it entails a transfer of exchange rate risk, and exchange rates are not static. Roll trades are less expensive because their risk is determined by interest rate differentials, which are usually fairly stable.

With respect to other types of instruments, FX futures contracts also incur generally low transactions costs, though without the benefit of custom settlement dates. Options, on the other hand, can be expensive and, depending on the structure used, can require an explicit outlay of premium.

Transaction costs

Passive hedging programs require trades when they are initiated, plus additional trades when the amount of underlying assets changes due to movements in the underlying markets and inflows or outflows. Passive programs also utilize lower-cost roll trades, typically once every three months. We estimate the transaction costs of a passive 100% hedge may be as low as 5 basis points per year.

Transactions costs can be higher for active management than for passive hedging because of the potential for a greater volume of transactions, although this varies according to the type of management. An additional potential modest cost is an FX prime broker (please see text box on prime brokers on page 40 for additional details).
Management fees and/or implementation costs
A large investor may have internal resources available for implementing a passive hedging program without incurring much additional cost. Smaller investors will need to set up an internal capability or pay an external manager for implementation. Some custodians, for example, offer currency hedging as an additional service. Beyond implementation, investors will need to devote some effort to monitoring and reporting on performance.

Active management fees vary widely, and are available as a fixed percentage of the amount of underlying assets, and sometimes as a performance fee with a small base fee. Performance fees can be problematic in mandates with asymmetric constraints because of the performance bias discussed in the constraints section. Extended trends in the base currency would lead to long periods during which the manager received either minimal performance fees or substantial performance fees.
CHAPTER 4

Implementation
Once an investor decides to hedge currency risk, either actively or passively, there are a number of items that must be addressed to ensure smooth implementation of the program. The first section covers the main types of financial instruments used in currency hedging. The second section addresses counterparties and the impact of changes in regulations. The third section is on flows of information.

Instruments
The three main financial instruments used for managing currency exposure are forwards, futures and options. Forwards and futures have a similar impact on portfolios, although there are technical differences between them that may make one or the other more suitable in specific applications. Options have quite a different impact on portfolios. Forward contracts were covered in an earlier text box (page 15), and below we will briefly cover futures and options.

Futures
The main difference between futures and forwards is that futures trade on an exchange whereas forwards trade over-the-counter (OTC).24 The counterparty to a futures contract is the clearinghouse of the exchange, while for forwards it is a bank. Clearinghouses tend to have better credit ratings than many banks. Also, clearinghouses require participants to fund margin accounts for initial and daily margin requirement purposes. Once the account is set up with the initial margin requirement, the account will be credited/debited on a daily basis, in base currency, the gains/losses of the positions based on changes in the price of the futures contracts. The margin account will need to meet the minimum amount of margin required (which is established by the exchange) in order to keep positions open. Traditionally, forwards have cash flows only once, on the settlement date, and don’t require margin. See the discussion below on counterparties, however, for how regulatory change is driving convergence between forwards and futures in terms of counterparty risk and collateral requirements.

Because futures trade on an exchange, they are less flexible than forwards. There are futures contracts on the major exchange rates, but not on less-traded exchange rates. Futures are limited to specific quarterly settlement dates, and each contract is for a standardized amount of currency. Forwards have none of these limitations: they cover virtually every exchange rate, any settlement date (excluding weekends and holidays) and
FX prime brokers

FX prime brokerage is a bundled set of services provided by banks to clients trading in the currency markets. Originally the purview of hedge funds, usage of FX prime brokerage expanded after the Global Financial Crisis across a wide range of institutional investors including corporations, mutual funds, pension funds and sovereign wealth funds, to name a few. This expansion was due primarily to the enhanced liquidity that prime brokers were seen to provide. The changing regulatory landscape not only served to constrain the market-making function of counterparties, but also increased the need for legal documentation (ISDAs and accompanying CSAs).

With the use of a prime broker, investors are able to trade with any number of counterparties, including smaller regional or specialist banks that would ordinarily be out of scope for institutional investors, without the need for additional legal documentation (other than with their prime broker).

In addition to providing efficient access to trade execution, prime brokers also provide real-time netting of positions (which may allow for decreased settlement risk and efficient use of credit lines, potentially reducing collateral requirements), trade clearing, and some optional ancillary services (one which is of particular interest to hedge funds is introduction to new sources of investor capital).

There are clearing costs (also known as “trade-away fees”) if trade execution is done with counterparties other than the prime broker, so the enhanced liquidity and operational efficiency do not come without some cost. In addition, concentration of counterparty risk can also be a concern.

Options

Someone who buys an option has purchased the right to make a currency exchange at the agreed strike price, but is under no obligation to do so. An option buyer will get the better outcome, regardless of whether the exchange rate moves up or down, but at the cost of the option premium. Options are a powerful instrument for managing currency exposure, but an expensive one. See also the discussion in Chapter 3 on dynamic hedging, a technique using forwards that seeks to replicate some aspects of option behavior. Most currency options trading is OTC, though there are a limited number of exchange-traded FX options. OTC options are subject to similar credit and counterparty considerations as forward FX contracts, and exchange-traded options have similar credit and counterparty considerations as FX futures.
**Counterparties**

Counterparties should be assessed by average transaction costs, credit quality and willingness to provide liquidity, among other criteria.

OTC instruments involve an extension of credit between the parties, at times substantial. If a forward contract has a large unrealized gain owing to an investor, for example, the bank on the other side of the contract is a major debtor to the investor. Investors should thus set a minimum threshold for counterparty credit quality. They should have multiple counterparty banks, to ensure best execution in trading and to diversify counterparty risk. Investors may also wish to set position limits for counterparties according to any differences in credit quality. Although the credit quality of major banks declined due to the financial crisis of 2008, restricting the universe of highly rated counterparties, this trend appears to be reverting somewhat. Nevertheless, investors should have a process in place for monitoring counterparties on a regular basis.

**Impact of regulations**

During the financial crisis of 2008, regulators and investors were very concerned about the solvency of financial institutions. These concerns led to a wave of regulatory reforms, many designed to bolster the capital position, and thereby improve the solvency of, banks and insurance companies in good and especially bad times.

OTC derivatives, including FX forward contracts, have come under scrutiny because they involve extensions of credit. These new requirements to set aside more capital for risk-taking activities have constrained the ability of banks to commit to market-making across asset classes, including currency, limiting the traditional role of banks as liquidity providers relative to prior to the financial crisis.

Prior to the Global Financial Crisis, institutional investors such as corporations and pension funds often executed in the currency markets without the benefit of documentation that delineated counterparties’ legal responsibilities to each other. After the crisis, however, banks began increasingly to require such institutions to expand their legal agreements beyond the traditional swaps and options, to currency transactions. These legal agreements, known as ISDA agreements, are templates that were originally created by the International Swaps and Derivatives Association in the 1980s to apply to the burgeoning swaps and derivatives markets. Amended several times since, the current “Master Agreement” lays out the roadmap for two counterparties’ exchange of currency, including provisions for termination, default, netting and, if including a Credit Support Annex (CSA), lines of credit. Although a standardized template, many investors and banks customize specific provisions in both the Master Agreement (via the “Schedule”) and CSA, requiring negotiation of sensitive key terms.

**Information flows**

Smooth operation of a currency hedging program requires periodic exchanges of
information between the investor and the currency manager.

**Investor to manager**

The manager needs to know the amount of underlying assets in each currency to be hedged. This information should be updated on a timely basis, especially when there are large changes in underlying assets from changes in asset allocation, inflows, outflows or price fluctuations. Failure to inform the manager of such changes could result in over- or under-hedging relative to the underlying assets. Computations of the performance of the currency manager and associated benchmark, as well as fees and performance fees, if any, are also linked to changes in underlying assets.

The manager doesn’t need to know anything else about the underlying assets; there is no reason to disclose the holdings. The investor can provide this information directly to the manager. If there is a custodian bank, it may be easier to instruct the custodian to supply the requisite information directly to the manager, although there can be a risk of error in any indirect transmission of information. The manager also needs to know who the approved counterparties are and position limits.

Another method used to communicate foreign currency exposures is to link them to an index rather than the actual assets. In this arrangement, an investor would instruct the currency manager to hedge the currency exposures of an index such as MSCI EAFE, assuming some initial amount of underlying assets. Changes in the managed currency exposures are driven by fluctuations of the index. From time to time, it will be necessary for the investor to change the assumed amount of underlying assets due to inflows, outflows and so forth. An advantage of this method is ease and transparency. A drawback is that actual underlying assets may not match at all times the currency exposures being managed.

If an investor has active managers for some of their foreign assets, coordination with the currency manager may be needed. Some international equity managers never hedge currency, in which case no coordination on that front will be required. If the international equity manager regularly hedges currency as a source of value-added, that portion of foreign assets should be excluded from the currency manager’s mandate. Otherwise, there is the possibility that the investor will at times be overhedged – i.e., have a net short position in a foreign currency, which may not be desirable.

**Manager to investor**

The currency manager needs to inform the investor as unrealized gains and losses accumulate so that the investor will be ready to provide liquidity if needed, or to reinvest when the forward contracts settle. If the hedging program uses a daily
mark-to-market mechanism, cash flows will take place daily, or as required, and communication will be needed between the investor and their counterparties (or prime broker).
CHAPTER 5

Monitoring currency policy
All major aspects of an investment program should be monitored regularly, and currency policy is no exception. This applies whether the currency policy is managed passively or actively. The first two sections of this chapter cover objective-setting and benchmarking. The last two sections are about monitoring and communication.

Specifying objectives
For a passive hedging program, a small amount of slippage in returns versus a currency benchmark should be expected. If the slippage is excessive, however, transaction costs may be the culprit, and will require further investigation. The risk of a passive hedging program should very closely match the risk of its benchmark.

For an active hedging program, there should be a mutual understanding between investor and manager regarding performance expectations, and a reasonable time period allowed for evaluating performance. We refer the reader to the discussion in Chapter 3 on position constraints, and how they can affect short-to medium-term performance expectations.

Benchmarking
Benchmarking a currency hedging program is different from benchmarking other asset classes because currency exposure usually comes from an underlying foreign asset which is not the responsibility of the currency manager. Consider a fund that represents equities in its strategic asset allocation using a global all-country benchmark. For the purpose of managing securities, let’s assume the fund breaks up the benchmark into three segments: US, global ex-US developed, and emerging markets. Let’s further assume that the fund has adopted a currency policy with a 50% hedged benchmark for global ex-US developed currencies.

For now, we focus on the global ex-US developed segment. The fund has managers of the underlying equities, and a separate manager for the currency exposure of the global ex-US developed segment. The fund needs an appropriate benchmark for its equity and currency managers. The equity managers have the usual kind of unhedged equity benchmark. The fund also needs a benchmark for the currency manager, but what should that be?

It should be the target portfolio that the currency manager visualizes as they manage currency exposure. That portfolio consists of a set of underlying currency exposures whose weights are given by the country weights of the equity benchmark. In this case, because the fund has a 50% hedge policy, 50% of each currency exposure in the benchmark is hedged into US dollars. The hedging within the benchmark is provided by hypothetical forward FX contracts. Note that the currency benchmark excludes the returns of the underlying equities because the currency manager has no control over them and does not, in effect, ‘see’ them; they are the responsibility of the equity managers.
There are two benefits to having this type of currency-only benchmark. First, it is the most transparent and accurate way to benchmark a currency manager. Second, it is an effective way to monitor the impact of currency on the portfolio independently from the underlying assets.

The fund needs a suitable benchmark for each mandate, and it also needs a way to aggregate the performance of individual mandates in order to track performance for each asset class and for the entire fund. In this example, the fund’s benchmark is global ex-US developed equities, 50% hedged. The aggregate portfolio performance for this segment is the performance of all of the relevant equity managers plus the performance of the currency manager’s portfolio of forward FX contracts.

**Monitoring return and risk**

The return of the currency hedging portfolio is calculated using an approach similar to the one described in the section on benchmarking. The underlying foreign currency exposure is exactly the same as in the benchmark. The return of the forward contracts (or other instruments, if applicable) is added to the return of the foreign currency exposure. The difference in returns between the portfolio and benchmark therefore comes down to the difference in returns between the actual forward contracts and the hypothetical ones (if any) in the benchmark.

Portfolio and benchmark should be compared on the basis of return and risk. Risk should be evaluated in the terms most relevant to the investor, and need not be limited to a single measure. Some investors monitor standard deviation of returns as well as drawdowns.

Assessing the difference in performance between portfolio and benchmark is crucial for evaluating how well the currency policy is being implemented. It is also useful to track the absolute performance of the currency benchmark and portfolio because these contribute to overall fund performance and investor objectives.

**Communication and education**

Communication on currency policy is especially important because opinions differ across the investment industry on how to deal with currency exposure. Once they have implemented their currency policy, investors should regularly communicate to their management its objectives, the principles on which it is based and performance. In such communications, it will be useful to make a clear distinction between: (1) the
performance of the strategic hedge ratio; and (2) its implementation. The strategic hedge ratio is designed to maximize return/risk and facilitate efficient use of the risk budget. Regarding implementation, if a passive approach is employed, the objective is to execute the strategic hedge ratio at a reasonable cost. An active implementation, on the other hand, will have its own objectives of augmenting returns and/or reducing risk relative to the strategic hedge ratio.

Communications regarding a currency hedging program should, ideally, be supplemented with a regular program of education regarding the currency market environment and how it relates to the investor’s currency policy. Investment managers, consultants and counterparties can often assist with this.
CONCLUSION

Currency policy should be an integral part of every investment program that invests in foreign assets. Our goal in writing this handbook is to provide in one place the basic information investors need to establish a sound currency policy. Currency policy consists of a strategic hedge ratio that maximizes expected return/risk (or some other investment objective) and a method for implementing the policy, either actively or passively. The methodology presented here is rigorous and transparent, and applies widely available inputs using the principles of modern portfolio theory.

Currency risk has been growing in portfolios as allocations to foreign assets have been increasing, and exchange rate volatility has been rising from relatively low levels. For investors who haven’t yet put in place a currency policy, there are strong arguments for doing so in the near future.

The key result of the analysis is that for a US dollar base currency investor, the optimal strategic hedge ratio for global ex-US developed equities is around 75%. In practice, a range of hedge ratios from 50% to 100% is also expected to provide substantial benefits. The 50% hedge ratio tends to have attractive properties, especially if an investor envisions managing currency exposure actively. The 50% hedge ratio provides fully 80% of the potential improvement in return/risk (relative to optimal). Also, assuming that the investor wants to limit currency exposure to the amount of underlying foreign assets (currency exposure range 0% to 100%), the 50% hedge ratio allows for symmetrical hedging activity around the benchmark. This makes it easier to assess the active management program, regardless of whether the base currency is strengthening or weakening.

One important conclusion is that it’s difficult to justify, from an investment efficiency standpoint, having a currency benchmark that is unhedged. Nevertheless, unhedged benchmarks are not uncommon. This implies that for some investors, a meaningful improvement in portfolio return/risk can be readily achieved by implementing a currency policy in which the strategic hedge ratio is between 50% and 100%. The savings in the risk budget from reducing unrewarded currency risk can then be redirected to other sources of incremental return.

The second part of the handbook assembles the data and reasoning needed for an informed investigation of whether currency exposure should be managed actively or passively. Traditional concepts of market efficiency don’t apply as well in currency markets as in, e.g., equities or fixed-income, because for many of the participants in currency markets, the primary objective is not necessarily maximizing the value of their currency exposure. Instead, for them, currency is a means to an end - a medium for exchanging money for goods and services across borders. Performance data of active managers support the notion that currency markets are not as efficient as their equity counterparts. The median active currency
manager had a significantly higher information ratio than the median active global equity manager.

The final chapters of the handbook cover implementation and monitoring. These are crucial aspects that require careful attention to ensure that investors get the most out of their chosen currency policy.

Endnotes
¹We invite non-US dollar investors to contact the authors for the relevant version.
²Table 01 uses local currency volatility for emerging market equities and bonds. Local currency volatility is very close to fully hedged volatility.
³For ease of illustration purposes, we used this simplified portfolio example.
⁴Currency exposure also affects some domestic assets, notably companies with global operations or global supply chains. For reasons of scope, this handbook is confined to foreign assets.
⁵Mean-variance optimization, which is part of modern portfolio theory, MPT.
⁶The reason we don’t compare unhedged returns to local currency returns is that local currency returns are not obtainable by foreign investors.
⁷We could use foreign exchange futures contracts, but these are not available for as many currency pairs or are as flexible as forward contracts. In any case, the results would not differ materially for our purposes.
⁸An extreme hypothetical example illuminates the argument. Suppose there exists a Japanese company that does the vast majority of its business in the US: most of its factories, offices and customers are in the US, yet the company is listed on the Tokyo Stock Exchange and its stock trades in yen. The market probably understands such a company, and its risk profile likely reflects its dollar orientation. US dollar investors shouldn’t hedge this company (although Japanese investors should!). There are few non-US companies with such a concentration in US dollar business, however (except for commodity-linked companies).
⁹5-year and 10-year horizons use rolling returns spaced one month apart.
¹⁰See Kenneth Froot (1993) for another perspective on time horizon.
¹¹The relevant correlation is between foreign currency and global ex-US equity fully hedged, and not with global ex-US equity unhedged in base currency because the latter contains the effects of foreign currency. Local currency returns would give very similar correlations to those using fully hedged returns.
¹²The exact result from the inputs in Table 03 is 74%, but note that there is some uncertainty in the inputs if one varies the date range or methodology. The result remains in the region of 75% under most circumstances, however.
¹³We find it encouraging that our own analysis using recent data (through December 2016) arrives at a similar result as Fischer Black in his seminal 1989 paper, which arrived at an optimal hedge ratio of 77%. Black, Fischer. "Universal hedging: Optimizing currency risk and reward in international equity portfolios." Financial Analysts Journal (1989): 16-22.
¹⁴One aspect where bonds differ from stocks is that the cash flows from sovereign bonds are not affected by currency fluctuations in the same way that the equities of multinational companies are. Exchange rates are an important driver of the earnings of multinationals, and earnings drive equity returns.
¹⁶We can work with investors on a case-by-case basis to provide currency hedging guidance for their alternative assets.
¹⁷Because there are so many potential factors, in the absence of a plausible rationale it would be easy to find factors that happened to work over a period of time, but were spurious, i.e., statistical noise, and therefore lacking in predictive power.
¹⁸Source: Mercer.
¹⁹To be included in the 5-year analyses, a manager must have reported its performance throughout the entire 5-year period.
Source: Deutsche Bank. The Carry Index ("Carry") systematically buys the top three-yielding currencies out of the G-10 and sells the bottom three-yielding ones based on three-month yields, with the position re-appraised every three months. As with any carry trade the aim is to extract the risk premium for taking currency risk.

The Momentum Index ("Trend") systematically buys the three currencies with the highest return over the previous year and sells the three currencies with the lowest returns. The idea here is to profit from the fact that currencies trend over time as prices adjust slowly to new information.

The Valuation (PPP) Index ("Value") buys the three most undervalued currencies and sells those three that are most overvalued based on the concept of purchasing power parity – on the basis that research suggests this concept holds up in the long term, which means currencies tend to move towards a measure of fair value.

We show the factor returns starting with the first month for which all three are available, which is September 2000. For additional information, please see https://gm.db.com/about/disclaimer.html

Costs could be somewhat higher, depending upon the trading method employed and counterparties, among other factors.

Futures are transacted by broker-dealers.

The credit risk of exchange-traded instruments is limited to a one-day price movement. One-day price movements, however, can be quite large.

Of course this also works in reverse: when the counterparty bank has a large unrealized gain on a forward, the investor is a debtor.

A counterparty with a higher credit rating might have a larger position limit than a counterparty with a lower rating, for example.

Some index vendors publish returns for currency benchmarks where the currency weights match the weights of the foreign assets in that vendor’s corresponding equity or fixed-income indices. Some vendors also publish returns of fully hedged currency exposures (again, excluding underlying asset returns). So if the strategic hedge ratio is zero or 100%, there may be an off-the-shelf index available. For ratios other than zero or 100%, however, it may be necessary to create (or have an index vendor create) a customized currency benchmark, which is a weighted combination of unhedged and fully hedged currency indices.

Ideally, the same spot exchange rates should be used to value both the live portfolio and the benchmark.
Model, backtested or simulated performance presented in this paper and further described below are for illustrative purposes and are not a representation of strategies currently managed by First Quadrant, L.P. and are provided solely for conceptual discussion only; therefore no fees are discussed or illustrated within this paper. Results from any live implementation of strategies discussed would in actuality be reduced by fees charged against an account deploying the strategy. Model, backtested, or simulated performance is no guarantee of the future results in a live portfolio using the strategy. Potential for profit is accompanied by possibility of loss. Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. Further, backtesting allows the security selection methodology to be adjusted until past returns are maximized. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. Unless otherwise noted, performance returns for one year or longer are annualized. Performance returns for periods of less than one year are for the period reported. Reinvestment of earnings was assumed. The simulated performance used in this presentation may differ from live performance experienced using the same strategies for a variety of reasons such as: The simulations assume that the strategy guidelines are constant through the life of the portfolio, whereas, the guidelines for live portfolios may change over the life of each portfolio; the simulations assume zero transaction cost whereas live portfolio transaction costs will be variable; dependent on market conditions such as liquidity and portfolio size, the types of instruments traded within the simulations may not have been permissible in a live portfolio; etc. Details specific to the simulations: Global ex-US equities includes simulated returns for the following development market countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, and the United Kingdom. The unhedged returns for each country is a simulation of the MSCI World ex-base country measured (not hedged) in the base country’s currency, where the country weights are rebalanced on a monthly basis. The hedged returns for each country is a simulation of MSCI World ex-base country hedged back to the base country’s currency, where the country weights are rebalanced on a monthly basis. The hedges are established with currency forward contracts on each respective currency and adjusted monthly on a per currency basis. Due to available index and hedging data, start dates of data for Finland is January 1988, for Norway is March 1984 and for Switzerland is February 1980. Before 1999, we used the average of all the "legacy" EMU countries as a synthetic EMU country in the dataset. Global ex-US bonds: includes simulated returns for the following development market countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. The unhedged returns for each country is a simulation of the Citi World Government Bond Index ex-base country measured (not hedged) in the base country’s currency, where the country weights are rebalanced on a monthly basis. The hedged returns for each country is a simulation of Citi World Government Bond Index ex-base country hedged back to the base country’s currency, where the country weights are rebalanced on a monthly basis. The hedges are established with currency forward contracts on each respective currency and adjusted monthly on a per currency basis. Due to available index and hedging data, start dates of data for Finland is May 1988, for Norway is February 1985 and for Switzerland is February 1980. US Bonds: Includes simulated returns for the United States.

For index definitions and trademark language used in this handbook, please visit https://www.firstquadrant.com/index-definitions for further information.