

## Currency - the tail that wags the dog

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J Ladekarl, D Levanoni & R Huo | First Quadrant | 18 August 2016

In portfolios with international exposure, there are times when currency returns dominate overall performance. Yet, for various reasons, there is a tendency to underestimate or set aside the impact of currency markets on portfolio risk. This paper analyses the currency hedge decision from the perspective of an Australian investor with international exposure. It finds that ignoring the unique characteristics of the Australian dollar can lead to suboptimal currency hedging decisions, with unnecessarily large tail risk. In particular, it illustrates that high static hedge ratios can have an outsized impact on portfolio returns during "risk off" events, as both equities and the Australian dollar tend to fall in value. In these cases, a static currency hedging policy would not lead to the desired reduction in overall risk. Ideally, a currency hedge program should improve the risk/reward characteristics of an international portfolio, reduce downside tail risk, maintain the underlying exposures, and limit calls for cash in periods of sharp benchmark declines. Those multiple objectives are difficult if not impossible to achieve with a static hedge ratio. As an alternative, this paper describes a dynamic approach to hedging the Australian dollar and contrasts the outcome of dynamic hedging with the results of different static hedge ratios.

### WHY WORRY ABOUT CURRENCY HEDGING?

Currency exposure is embedded in almost all international investments, which can complicate risk management for asset owners. The strategic asset allocation decision undertaken at a portfolio management level has had a tendency to underestimate the impact of currency on portfolio risk. In particular, it may underestimate tail risks from currency exposure, with moves large enough to effectively wipe out all other returns in the short term, and thus drive performance if left unchecked. These "tail" risks, while by definition low probability events, have the potential for a large impact on the portfolio as a whole, effectively wagging the dog.

How exactly does a traditional approach fall short?

The basic inputs to a standard strategic asset allocation are the expected return, expected risk, and expected correlations of different asset classes – typically arrived at by blending historical experience with market- and investor-based forward-looking expectations. However, regardless of the source of these expectations, this exercise comes up short at the outset by failing to explicitly model currencies. Currency returns are simply assumed to be

zero over the long run. While this may be true over the course of several decades, currency moves over the short term may still be quite large and variable.

A search for input from empirical or theoretical literature on the riskiness of currencies yields little useable guidance.<sup>1</sup> The most robust theoretical result is a simple one from Fischer Black who, in a variant of the so-called "Siegel's paradox", provides evidence that it is suboptimal for an international equity portfolio to hedge currency risk fully, leading to an optimal hedge ratio lying somewhere below 100%.<sup>2</sup> This can be used as a starting point, but it does not provide a final solution by any means.

In the end, the decision on how to treat currencies in the context of the strategic asset allocation is either relegated to a separate discussion on the hedge ratio (and then delayed or forgotten) or driven by practical considerations (cash flows, counterparty risk management, operational complexity, peer risk, etc.) often leading to herding behavior and corner solutions: 100% hedge, 50% hedge or 0% hedge.

**Figure 1: Practical drivers of static hedge ratios**

Drivers	Explanation / Comments
FACTOR 1 Minimisation of total portfolio risk	Based on asset allocation, currency base, the time period chosen for the analysis, s currency hedging is one possible tool.
FACTOR 2 Control of currency volatility	Based on the assumption that currency m will wash out in the end, full insulation against short-term currency volatility will to no strategic currency exposure.
FACTOR 3 Control of cash flows/ opportunity cost of hedging when base currency depreciates	Conversely, if the minimisation of cash fl volatility is an overriding priority, then an unhedged benchmark is favored.
FACTOR 4 Minimising complication	Advisors and investors are usually more comfortable with fewer variables and sim risk management.

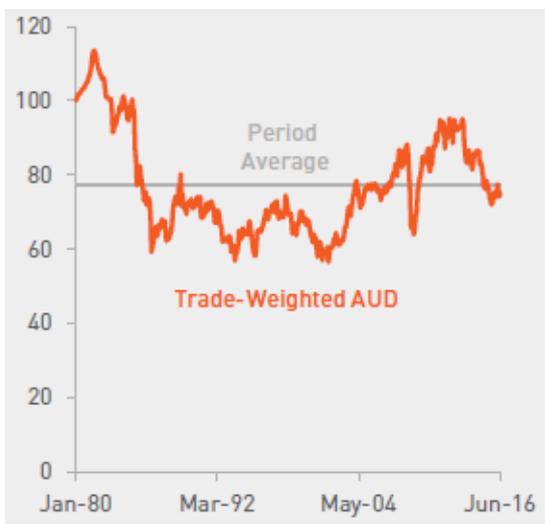
↳ These drivers often lead to herding behavior and corner solutions: 100, 50 or 0 perce hedge ratio

Source: First Quadrant

It might be appealing to reduce the complexity of the exercise by presuming that the cyclical behavior of currencies implies that they have minimal impact over the long term. One might then blithely choose a simplistic hedge ratio and be content that it will all come out in the

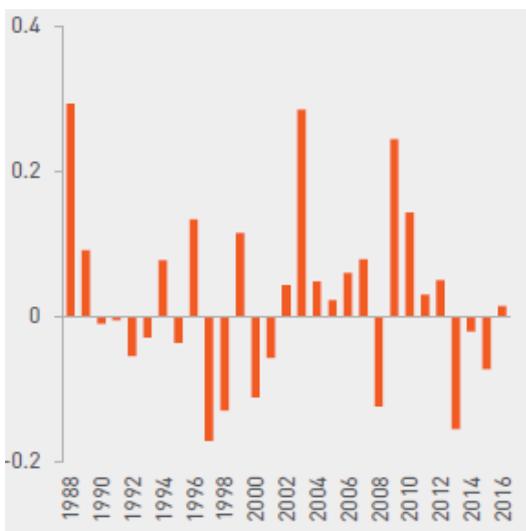
wash. However, such an approach ignores the length of those reversion cycles and the magnitude of the gains and losses along the way (Figure 2). The seemingly "benign" choice of a static hedge ratio for the asset allocation benchmark has profound impact on relative fund performance and relative risk experience over time horizons most investors actually care about (Figure 3).

**Figure 2: Currency cycles are long – Trade-weighted AUD**  
(January 1980 – June 2016)



Source: Reserve Bank of Australia

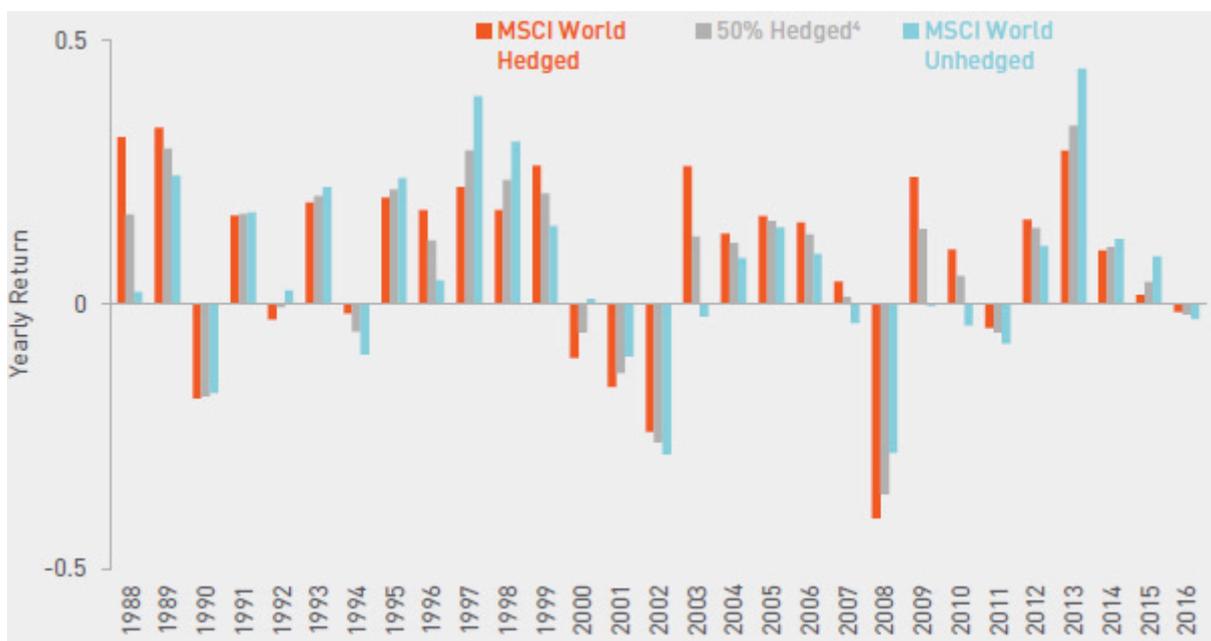
**Figure 3: Currency effects are large**  
MSCI World Index hedged vs unhedged AUD returns (January 1988 – June 2016)



Source: Bloomberg, LP, First Quadrant, L.P. The currency effect is calculated as the difference between the 100% Hedged and Unhedged AUD returns of the MSCI World Index.

Over the course of the 24 years to 30 June 2016, an Australian investor has experienced 10 years where the difference between hedged and unhedged returns was over 10 percentage points, and seven years where the magnitude of return difference between hedged or unhedged returns was larger than the magnitude of the hedged returns themselves (Figure 4). There's not much of a wash in the short term.

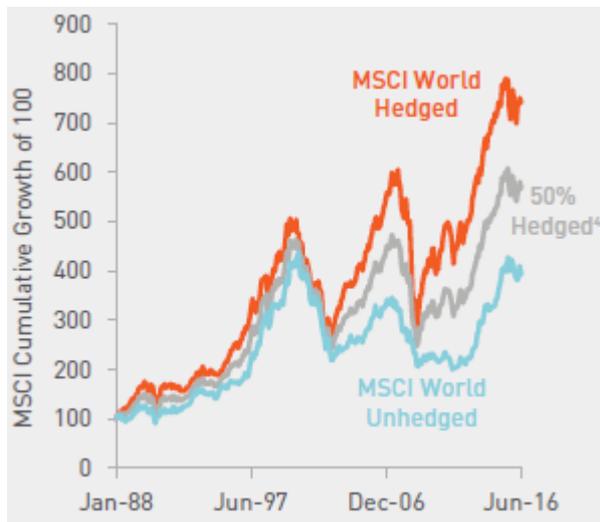
**Figure 4: Yearly returns of the MSCI World Index in AUD<sup>4</sup>**  
(January 1988 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P.

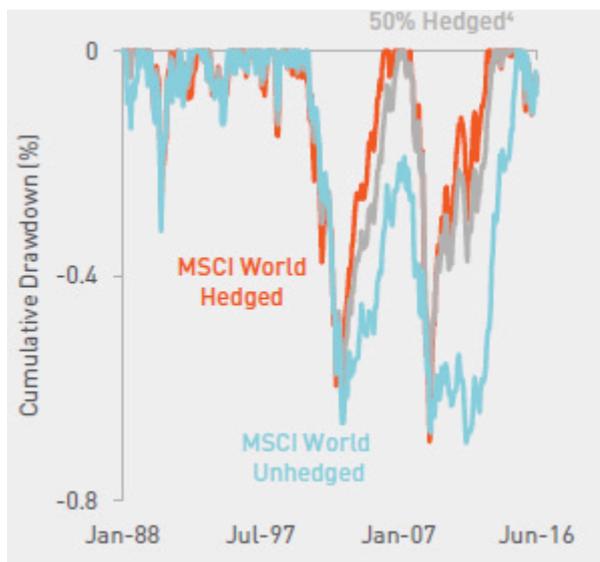
There has also been extended periods of time over which the choice of not hedging has significantly underperformed the choice to hedge (Figure 5) and with significant differences in drawdown profile (Figure 6)

**Figure 5: Cumulative growth of the MSCI World Index in AUD<sup>4</sup>**  
(January 1988 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P.

**Figure 6: Drawdown of the MSCI World Index in AUD<sup>4</sup>**  
(January 1988 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P.

While it may be a true assertion that currency risk may wash out over time, longevity of currency cycles and the magnitude of the effects of currency fluctuations are so large that even the seemingly "safe" choice of a 50% hedged benchmark<sup>4</sup> no longer seems so safe. It appears investors ignore currency risk only at their peril. Currency risk is wagging the dog.

## WHY WORRY ABOUT CURRENCY TAILS?

The question of addressing currency risk in a portfolio context takes on even more importance when moving into the tails of the return distribution. Indeed, the exercise is complete only when focused on the currency impact when losses are extreme rather than just "normal".

One of the fascinating aspects of currencies is that the return and risk characteristics of a currency are not set in stone. Looking across currencies, a high-yielding currency, for example, has meaningfully different distributional and correlation characteristics than a low-yielding currency. Similarly, looking across time, on a relative basis, countries and their currencies go through extended periods during which they are high yielders and low yielders. In addition, yields are not the only economic characteristic impacting the way a currency behaves. Current account deficits or surpluses, capital account surpluses and deficits, balance sheet composition, reserve currency status, economic growth, population growth, changes in reserve status, etc. are all characteristics that change over time on a relative basis, and change the characteristics of the currencies with them.

This property – currency characteristics vary on a time-relative basis – makes it nearly impossible to establish a static hedge policy based on a blunt treatment of historic data. In order to arrive at a policy that will fit an investor's portfolio, these different regimes must be taken into account. Furthermore, that policy may require updating over time, based not just on investor objectives, but on changes to the nature of the currency itself. Finally, the standard assumptions about an intermediate-term mean return of zero may not hold for all currencies at all times. If that indeed is the case, then the optimal hedge policy will vary according to where a country (or block of countries) is in the economic development cycle.

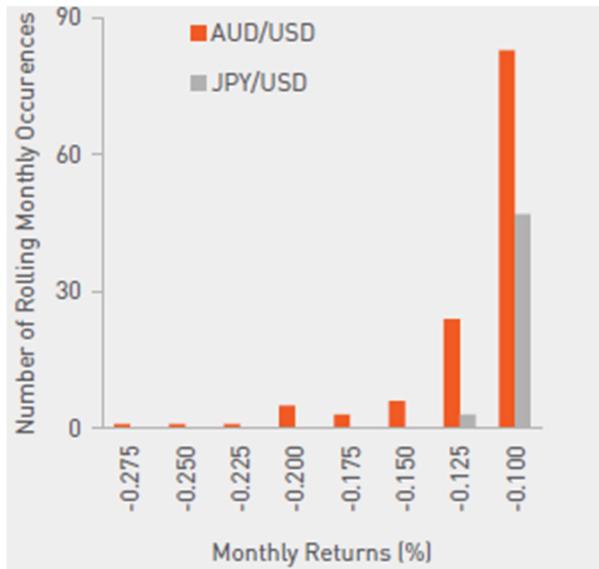
## CONCERNS FOR THE AUSTRALIAN INVESTOR

Australian investors, in particular, have a unique set of concerns. First, the challenge is clearly how best to set a currency hedging policy in the context of a high-yielding domestic currency. The distributional characteristics in the tail of a high-yielding currency are different from those of a low-yielding currency (Figure 7), a difference which cannot easily be ignored. Considering the Australian dollar within a regime framework, we also see that the distributional characteristics in the tail vary over time, as mentioned above (Figure 8).

A fat left tail is evident when comparing to the JPY, indicating that the AUD has had larger negative returns than both a low-yielding currency and what the normal distribution would predict. Similarly, a fat left tail is also evident when comparing the distributions of returns over periods in which the AUD was a high yielder to periods in which the AUD was a low yielder in relation to other countries in the G10 universe. These observations change the way we should think about hedging in the context of the strategic asset allocation. If we define risk and risk appetite as taking a normal distribution of returns as the starting point, using

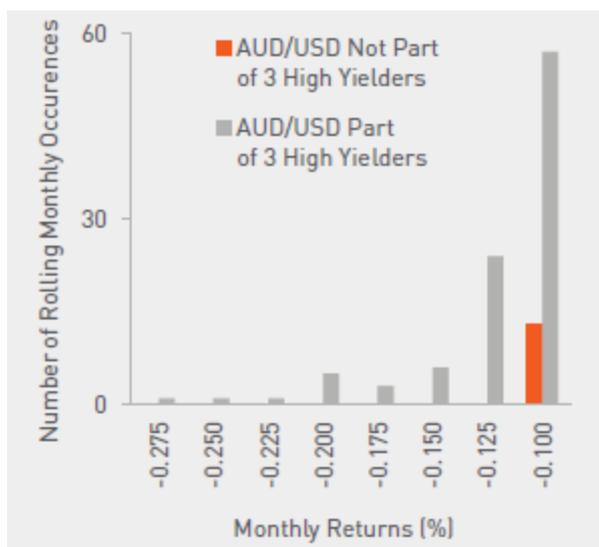
the one standard deviation level as the sole definition of risk, then we underestimate the impact that currency risk may have on the portfolio.

**Figure 7: Monthly return histogram tail of AUD and JPY**  
(January 1988 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P.

**Figure 8: Monthly return histogram tail of AUD as a high and low yielder in G10**  
(May 1990 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P.

There is another far graver oversight specific to the Australian case. A standard approach will have failed to take into account the correlations of the currency exposures to the underlying portfolio exposures and the potential tails in those exposures.

With a higher-yielding AUD compared to other currencies, unhedged international exposure for an Australian investor can be summarised as a short carry trade (i.e., short high-yielding AUD and long lower-yielding foreign currencies). This description is a useful construct in helping understand the underlying correlations, and this short carry exposure is correlated in different ways to the underlying positions depending on those exposures. International equities or equity-like investments (such as emerging market bonds) have a negative tail of their own. The short carry trade embedded in an unhedged international equity position for an AUD-based investor is negatively correlated to the underlying equity positions – removing that embedded position (i.e., hedging the currency back to AUD) removes the diversification benefits and increases negative tails (Figures 9 and 10). In other words, hedging, while reducing risk as measured in standard deviation terms, increases risk as measured in the tail if the underlying investment is international equities and the home currency is a high-yielding currency.

**Figure 9: Monthly return histogram tail MSCI World Index in AUD**  
(January 1988 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P.

Figure 10: Skew for MSCI World Index in AUD

	MSCI World Hedged	50% Hedged <sup>4</sup>	MSCI World Unhedged
Full Sample Jan 1988 – June 2016	-0.92	-0.65	-0.08
Last 36 Months ending June 2016	-0.18	-0.15	0.18

Sources: Bloomberg, LP, First Quadrant, L.P.

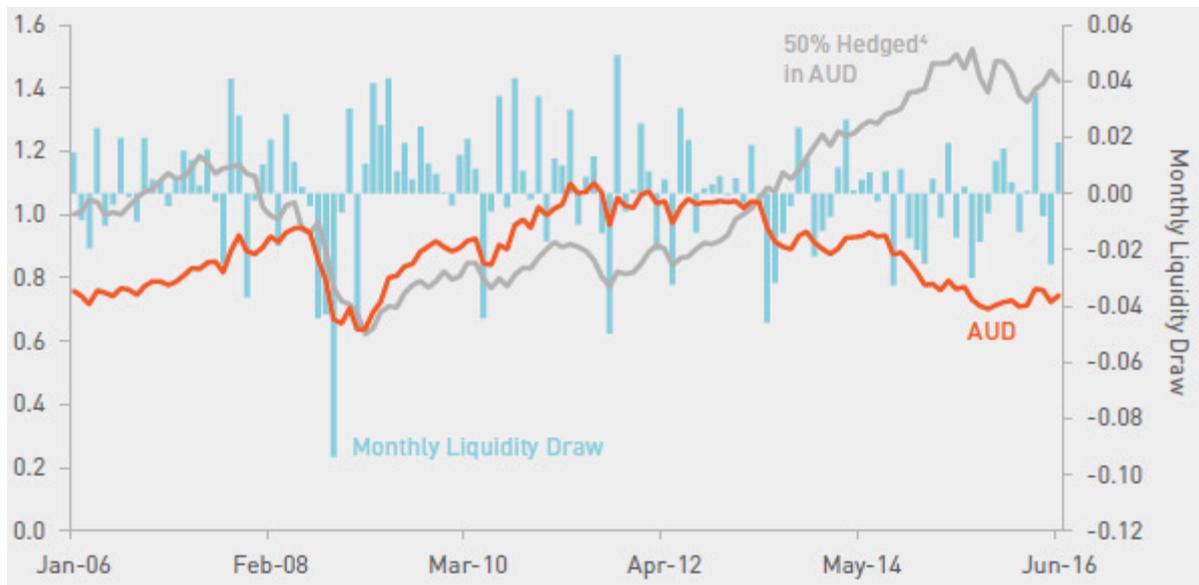
A third concern is that the impact on the reduced diversification benefits from currency hedging at times of large downward movements in the underlying asset exacerbates the liquidity risk a hedged investor faces. How does that happen? Shouldn't the losses on a hedge be perfectly balanced by gains (measured in local currency) in the underlying asset (ignoring imperfect hedges, transaction costs, etc), leaving the investor with the ability to sell off the underlying asset to pay for losses on the hedge?

In normal times, this theoretical equality holds up just fine. However, in times of stress, the assumption ignores the effect of holding a very liquid liability and a potentially much less liquid underlying asset. This is, in particular, a problem for the outbound investor with a high-yielding domestic currency where the equity tail and the currency hedge tail are correlated, as is the case for many Australian investors. Here, the static hedge exposes the portfolio to illiquidity risk as calls for cash to fund losses on the hedge typically occur as the underlying assets are declining in value and in liquidity (Figure 11).

Ironically, this typically happens at times when longer-term investment opportunities are created through fire sales of less liquid assets – exactly the kind of opportunities for which investors would like to preserve dry powder. This ill-timed liquidity draw not only bears an opportunity cost, but is the equivalent of being forced to provide opportunities for other investors just to cover the losses stemming from the hedge portfolio.

The combination of these concerns makes the use of a static hedge ratio unnecessarily risky and ill-advised, especially for the Australian investor. Using such a non-specific tool, in an exceptionally specific and unique situation, means currency tail risk is now wagging the dog.

Figure 11: Liquidity draw from a 50% global equity portfolio in AUD  
(January 2006 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P.

## A DYNAMIC ROADMAP

The task, then, is to develop a better mechanism for currency hedging that can mitigate the effects of these concerns.

Tail events tend to happen in an abrupt and discontinuous manner. When designing strategies to hedge against negative tails, it's necessary to plan for two scenarios that lead to downward corrections in asset prices:

1. Bad outcomes from a lot of small events adding up to a big one; and,
2. Bad outcomes of large exogenous or endogenous shocks.

Critically, this implies that investors have to plan prior to an event since there may be little time to react while events are unfolding.

This particular feature of asset market behavior can be taken into account through a hierarchy of actions (Figure 12). This approach starts with a strategic construction of portfolios so as to minimise negative tails (through, for example, risk weights rather than capital weights), and is followed by a dynamic asset allocation (adjusting exposures over time based on views on when tails will occur). This process then continues by using proxy

hedges (such as programs that have a positive mean and a substantial positive skew) and lastly by explicitly hedging (through, for example, collar strategies).<sup>3</sup>

**Figure 12: Alternatives for tail-risk hedging**



Source: First Quadrant, L.P.

A hedging hierarchy exists. A costless "simple free lunch" option only comes in the portfolio construction phase, the base of the hierarchy, where diversification has the ability to provide the risk reduction. The dynamic allocation across assets is the next step which comes at a cost in terms of complexity and risk. In this step, the potential benefits of tail hedging also come from diversification, specifically the benefits of time-varying exposures to different asset classes. However, that extra decision to dynamically allocate assets entails a risk of its own (since skill is required to achieve this goal). The proxy-hedging strategies (such as certain types of active currency programs) are believed to be beneficial because they may have a positive expected mean (you don't pay for the tail hedge). However, they also require skill, and the hedge for the tail is just a "proxy" hedge where there is a probability, but not a guarantee of working during a particular event. Lastly, at the top of the hierarchy are the explicit hedges that are tailored to work exactly when investors want them to work, but come with either explicit costs (through payment of premium) or implicit costs (e.g., the opportunity cost of selling some upside gains to protect some downside losses).

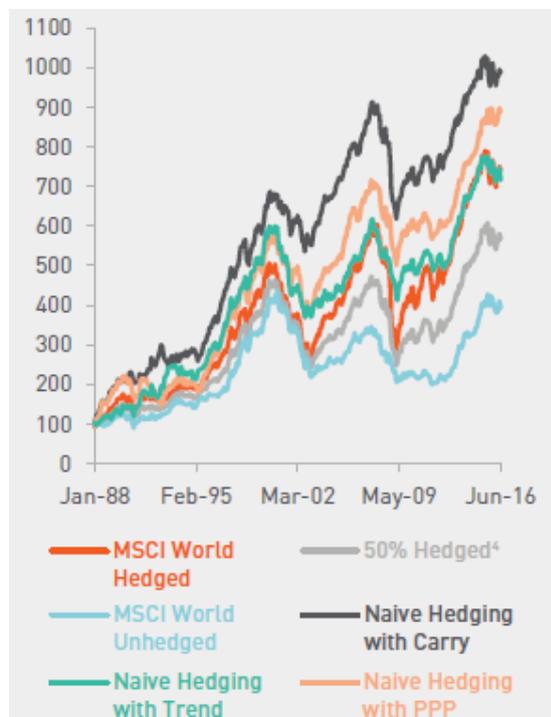
Adopting components of this general approach to the currency hedging decision provides some practical guidance as to how to structure a hedging program. The first step is to define the objectives. A currency hedge program ideally should improve the risk/reward characteristics of an international portfolio, reduce downside tail risk, maintain the underlying exposures, and limit calls for cash in periods of sharp benchmark declines.

One way of achieving those objectives is to implement a time-varying hedge ratio for the AUD. This variable hedge ratio reflects the fact that AUD risk is not static, and that

fluctuations in the relative riskiness of the AUD will provide guidance as to when to hedge and when not to hedge. When the AUD compared against the relevant basket is seen as risky, the best thing to do is step aside and reduce the hedge ratio. Conversely, when foreign currencies are viewed as more risky than the AUD, one should increase the hedge ratio. In practice, a successful dynamic approach requires skill and the ability to determine the hedge riskiness in a dynamic fashion.

The appeal of a dynamic approach is evident in the context of overall portfolio management discipline. As a general rule, the overriding principle behind asset allocation, in most portfolios, is one of diversification – diversification across different asset classes, diversification across time, diversification across managers, and lastly through managers' diversification across underlying securities. One decision that often misses this diversification benefit is the currency hedge policy. This diversification effect can come through a time-varying currency hedge policy which may lift the efficient frontier. Considering the size of the not-so-hidden risk embedded in the not-so-benign naive hedging solutions (Figure 13), the decision to diversify the strategic hedge policy may be one of the more important decisions left to make.

**Figure 13: MSCI World Index in AUD: Naive hedging illustration<sup>4</sup>**  
(January 1988 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P. See Naive Currency Hedging Non-Proprietary Model Performance disclosure for more information on Naive Hedging data.

## HEDGING THE AUSTRALIAN DOLLAR

The "riskiness" of the Australian dollar can be identified through an estimation of the likelihood that AUD is going to depreciate or appreciate against a basket of currencies, relying upon inputs from a number of long-term factors that demonstrably drive currencies. This allows us hedge ratios to vary in a dynamic fashion with compelling results.

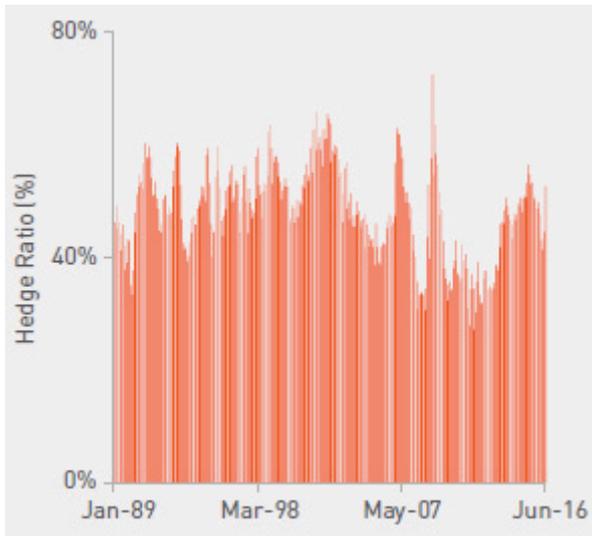
The factors discussed in this paper, which are only a few of what can be deployed, use a valuation anchor (through a proprietary version of PPP), capital flow factors from equity, bond and cash markets and, lastly, factors driven by intermediate-term inflation differentials to establish a view on the Australian dollar relative to a basket of developed market currencies. The time-varying fluctuations of these factors reflect the fact that AUD risk is not static and provides guidance on when to hedge and when not to hedge.

The hedge approach now flows from this risk assessment of the AUD. If the AUD appears likely to stay at current levels or is poised to weaken against other currencies, then the hedge ratio can be reduced to the lowest level allowed by investor or fund guidelines (e.g, to zero if that is allowed). If the AUD is believed to be going to strengthen against other currencies, the foreign currency exposures would be opportunistically hedged and the hedge ratio increased all the way toward 100% (again, if allowed by the investor or fund guidelines) based on the current assessment of AUD strength against its historic levels. The approach implies that the hedge against individual currencies will be off at times and on at other times, with varying strength.

As an example on the extreme side, Figure 14 illustrates the dynamic nature of the process that may be applied for the base currency, AUD.

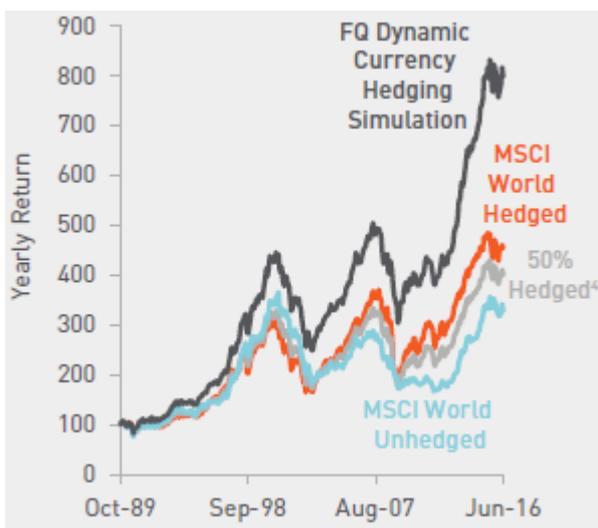
As AUD is identified as being either over- or undervalued against a cap-weighted average of foreign currencies, the hedge ratio varies. As currency cycles are long, there may be extended periods of time where a smaller hedge ratio is maintained, on the expectation that foreign currencies will strengthen against the AUD, or vice-versa. The simulated portfolio featured here provides even further potential benefit by assessing each currency's dislocation relative to fair value against AUD, other than simply AUD versus a cap-weighted average of these currencies.

**Figure 14: AUD modeled dynamic hedge ratio**  
(January 1989 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P. See FQ Dynamic Currency Hedging –Simulated Performance disclosures for more information.

**Figure 15: Modeled return of MSCI World Index in AUD vs FQ Dynamic currency hedging simulation<sup>4</sup>**  
(October 1989 – June 2016)



Sources: Bloomberg, LP, First Quadrant, L.P. See FQ Dynamic Currency Hedging –Simulated Performance disclosures for more information.

## CONCLUSION

A dynamic hedge approach is able to improve most of the characteristics of the return distribution relative to the alternatives. It can lower the risk of the overall equity investment compared to a static 100% hedged program, as well as potentially improve the distribution through a reduction of skew compared to the 50% and 100% hedge choices.

In addition, a dynamic hedge program can provide positive returns compared to the static hedging alternatives. The best results, solely in terms of tail risk reduction, can be found with a 0% hedge program. However, this risk reduction tends to come at a high cost in terms of forfeited return, illustrating the trade-off that investors face when making choices about hedging.

Investors can benefit from explicitly considering their currency exposures in the context of their strategic asset allocation. Imposing a static framework is not ideal, as currencies may exhibit vastly different characteristics over time depending on the underlying economic fundamentals. A dynamic currency hedging framework is suggested to address changing risk and return characteristics. Further, the impact currency risk can have on portfolio performance simply cannot be captured through a narrow focus on the standard deviation of returns. The impact on tail risk and specific timing of cash flows are other characteristics that clearly matter as well. It is a complex problem that requires a sophisticated and dynamic solution.

**Figure 16: MSCI World Index in AUD modeled risk / return characteristics**  
(October 1989 – June 2016)

	MSCI World Hedged	50% Hedged <sup>4</sup>	FQ Dynamic Currency Hedging Simulation	MSCI World Unhedged
Annualised Return	0.058	0.053	0.081	0.045
Return/Risk	0.412	0.416	0.639	0.346
Risk	0.142	0.128	0.127	0.131
Skew	-0.913	-0.680	-0.424	-0.149

Sources: Bloomberg, LP, First Quadrant, L.P.

Using a subset of the active currency approach in the simulation presented in Figure 15 and Figure 16, it is possible to vary the timing and magnitude of the hedging decision.

This approach aims to significantly improve the performance characteristics of international equity investments for Australian-domiciled investors by seeking to:

1. increase risk-adjusted returns;
2. provide cash in times of losses in the equity tail; and,
3. deliver less skew than the most commonly used static hedged benchmarks in an effort to more aptly mitigate currency risks.

The time-varying characteristics of currencies, coupled with the current high-yielding status of the Australian dollar, presents a unique set of challenges related to, in particular, the behavior of the Aussie dollar when equity markets experience negative tail events. Australian investors with international portfolios can benefit from varying their hedge decisions based on a dynamic assessment of how likely it is that the Australian dollar will face downward pressure over the medium term. Such a process may result in a portfolio in which it is far less likely that the "currency tail will wag the dog."

## ENDNOTES

1. "The optimal hedge ratio varies over time", "The optimal hedge ratio depends on the time period analyzed and the base currency in question", etc.

2. Fischer Black, "Universal Hedging: Optimizing Currency Risk and Reward in International Equity Portfolios", *Financial Analysts Journal* (July/August 1989):16-22.

3. We have written about these different approaches to hedging in various FQ perspectives. See for example: "Slimming Your Tails: Constructing a Superior Tail-Risk Hedging Portfolio, October 2010.

4. The 50% Hedged data stream is calculated by First Quadrant, L.P. incorporating data from MSCI. It is derived by summing the unhedged MSCI World Index - AUD and the MSCI World 100% Hedged to AUD Index and dividing it by 2. Neither MSCI nor any other third party involved in or related to compiling, computing or creating the MSCI data (the "MSCI Parties") makes any express or implied warranties or representations with respect to such data (or the results to be obtained by the use thereof) and the MSCI Parties expressly disclaim all warranties of originality, accuracy, completeness, merchantability or fitness for a particular purpose with respect to such data. Without limiting any of the foregoing, in no event shall any of the MSCI Parties have any liability for any direct, indirect, special, punitive, consequential or any other damages (including lost profits) even if notified of the possibility of such damages.

## DISCLOSURES AND INDEX DEFINITIONS

FQ Dynamic Currency Hedging - Simulated Performance: Unless otherwise noted, performance figures do not reflect the deduction of investment advisory fees. These fees are described in below. The returns shown will be reduced by the advisory fees and any other expenses the advisor may incur in the management of an investment advisory account. 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. General Disclosure: Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Also, since the trades have not actually been executed, the results may have under or over compensated for the impact, if any, of certain market factors, such as lack of liquidity. 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. The simulated performance presented differs from live performance experienced using the strategy for the following reasons:

- The simulated performance presented are calculated by the retroactive application of a model constructed on the basis of historical data and based on assumptions integral to the model, i.e. “backtested.” The simulation assumes all trading takes place once a month (on the last day of the month) whereas live portfolios may trade more often or at other times during the month.
- The simulation assumes that the guidelines are constant through the life of the portfolio, whereas the guidelines for live portfolios may have changed over the life of each portfolio.
- The simulation assumes implementation of the strategy via option and or forward contracts, whereas live portfolios may use other instruments (i.e. futures) with a different return or cost.
- The simulations use a “synthetic Euro” for the period before January 1999, whereas live portfolios using this strategy before January 1999 would have used the “Legacy” currencies (ATS, BEF, FIM, FRF, DEM, IEP, ITL, NLG, PTE, ESP).

Disclosures Specific to Simulation: (Creation Date: July 2016)  
The simulation was constructed with the following investment objectives: 1) Improve the risk/reward characteristic of an international portfolio held by an Australian investor, 2) Reduce downside tail risk, 3) Maintain underlying exposures, and 4) Limit calls for cash in periods of underlying sharp index declines. The simulation is based in Australian Dollars and uses the MSCI World Index denominated in AUD, and the backtested signals for the AUD, CAD, EUR, JPY, NOK, NZD, SEK, SGD, CHF, GBP and USD. The simulation is allowed to fully hedge or unhedge the currency risk from the AUD denominated MSCI World Index. Hedging in the simulation is executed through forward trades in AUD, CAD, EUR, JPY, NOK, NZD, SEK, SGD, CHF, GBP and USD. No transaction costs were assumed. This simulation assumes no reinvestment of earnings, cash balances, or treatment on tax.

Investment Management Fees: Performance results presented are net of investment management fees. The FQ investment management fee schedule for this strategy, which is negotiable, is risk level dependent. Portfolios carry a base fee equaling .125% per 1.00% of targeted risk. The fee schedule for this simulation assumes a flat 0.125%. Market Impact On Returns: Certain material market or economic conditions can impact the returns of an investment strategy. We have provided below what we believe to be a fair, yet subjective, assessment of those outliers that have significantly and positively impacted the strategy’s performance. In 1990 we were favorably positioned for the large appreciation of both the EUR and against AUD; In 2008 we were favorably positioned for the large appreciation of the USD against AUD; In 2013 we were favorably positioned for the large appreciation of both EUR and USD against AUD. In all three instances we were able to take advantage of these significant moves.

Naive Currency Hedging – Non-Proprietary Model Performance (Gross of Fees): Model performance figures do not reflect the deduction of investment advisory fees. This simulation is based on non-proprietary models, which is used for educational purposes; therefore no fees are deducted. First Quadrant does not offer these strategies for investment purposes. The model performance of the naive hedging strategies come from the following three industry standard strategies:

- Carry refers to the strategy of selling the three lowest yielding currencies and buying the three highest yielding currencies

• PPP refers to the strategy of selling the three most overvalued currencies and buying the three most undervalued currencies with respect to the annually published OECD fair value exchange rates; • Trend refers to the strategy of selling three currencies with the lowest three-month trailing returns and buying three currencies with the highest three month returns. All three naïve strategies choose from the following basket of currencies: AUD, CAD, EUR, JPY, NOK, NZD, SEK, CHF, GBP and USD. The model performance presented are calculated by the retroactive application of a naïve strategy constructed on the basis of historical data and based on assumptions integral to the strategy, i.e. “backtested.” The model assumes all trading takes place once a month (on the last day of the month). The model assumes implementation of the strategy via forward contracts. This simulation does not include transaction costs.

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*Dori Levanoni is Partner – Investments with [First Quadrant](#). He is involved in all aspects of product development. Jeppe Ladekarl is Partner – Investments with First Quadrant. First Quadrant partners with global asset management company, [Affiliated Managers Group](#).*

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