William Blair

November 2014

Dynamic Allocation
Strategies Team

Currency Management: The Case for Value Investing

The Dynamic Allocation Strategies (DAS) team has made significant use of dynamic currency management in the pursuit of their investment performance objectives. Currency exposures are managed actively and separately from asset class and market exposure in a return-seeking context—to add value to portfolios.

The DAS team is particularly active in global currencies: currency is expected to contribute half of the portfolio's active risk over the long term. That is, the active risk budget devoted to currency exposure is equal to the active risk budget allocated to markets and asset class exposures over time. A material part of the team's performance is thus expected to come from currency management.

One reason for this significant allocation of the risk budget to currency is the large diversification benefit that a dynamically managed currency strategy is expected to provide to a top-down (macro) portfolio. In Equilibrium, currencies have no correlation with assets and, therefore, should be expected to deliver performance that is generally uncorrelated with market strategies. This relationship between currencies and markets is embodied in the DAS team's long-term, forward-looking Equilibrium risk model. Over shorter horizons, and embodied in the team's forward-looking Outlook risk model, correlations between currencies and markets can be non-zero, but they tend to still be low relative to, say, the correlation of one equity market with another, or one bond market with another. This means that even if the active currency risk is large in isolation, its contribution to total portfolio risk should typically be low because of diversification effects. This has been the DAS team's experience for more than a decade. Inclusion of currency thus "punches above its weight" in respect of contributions to return and contributions to risk of a dynamically managed top-down portfolio and this argues for an active currency strategy to be employed meaningfully over time, even though there are fewer currencies in the investable universe than there are markets (there are approximately 32 currencies currently in the DAS team's investment universe, as compared to around 75 different equity and fixed income "buckets", which represent countries, sectors, and credit categories).

Another reason for the generous use of currency strategy in the DAS team's portfolios is the efficacy of exchange rate reversion to fundamental value. The foundation of the DAS team's investment process is the determination of fundamental values for asset classes, markets, sectors, and currencies, and the identification of investment opportunities defined as significant discrepancies between prices and these fundamental values. Adherence to the reversion of price to value is a cornerstone of the justification of major investment exposures in the portfolio as well as the belief that value exerts an inexorable pull on price over the medium-term. Fundamental value is a discounted cash flow concept for markets, and a relative purchasing power parity concept for currencies, and the DAS team's valuation methodology is described in two papers separately available from William Blair upon request.

While fundamental valuation is only the first step of the team's investment process, and is not a near-term prediction of price movement in markets or in currencies, the team observes that the pull of value on price is at least as powerful for currencies as it is for assets, which means that currencies create significant investment opportunities. While this finding is supported by rigorous academic research (for example Jorion and Abuaf (1990) or Rogoff (1996)), it is contrary to the consensus of many investment professionals, who tend to be skeptical about the possibility of adding value by investing in currencies. But if currencies revert to fundamental values over shorter horizons than equities and bonds do, we believe this property of currencies is an additional reason why currency strategies should be aggressively used, even more aggressively than would be indicated by the narrower breadth of the currency universe as compared to the market universe. This note summarizes the findings in respect of faster—or less slow—reversion of currencies to fundamental values than is the case for markets. With respect to the analysis referenced herein, the findings are for a selection of developed equity and bond markets and a selection of emerging and developed currencies. Broadly noted, the time taken for exchange rates to revert to fundamental value is shorter than for assets. Accordingly, the probability of reversion to value, looking forward from any point in time, is larger for exchange rates than is for equity and bond markets.

Data

We conducted simple tests involving eight currencies (seven exchange rates): the U.S. dollar, euro, Japanese yen, Australian dollar and British pound from the developed world, and the Mexican peso, Philippine peso and South African rand from three emerging regions. For assets we analyzed the national equity markets of the G7 (U.S., Japan, Germany, UK, France, Italy, and Canada) and U.S. government bonds. We used monthly data from 1973 to mid-2014 as this corresponds to the floating exchange rate era.

Estimating Fundamental Value

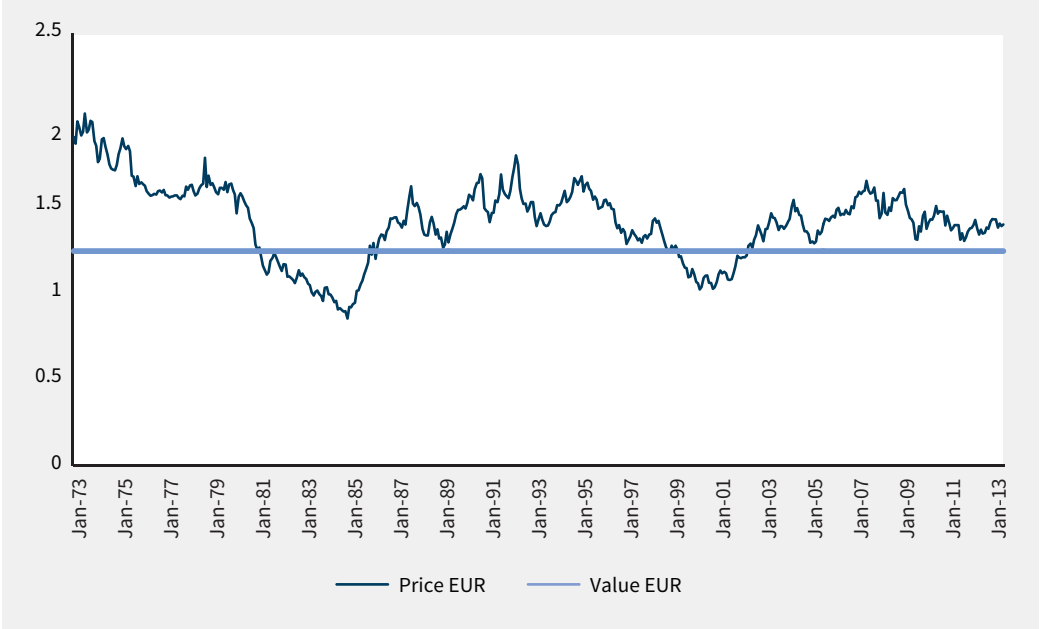
The DAS team determines fundamental values of all currencies and equity markets with models that were developed and refined during the last 30 years and that require multiple qualitative inputs as described in two separate papers mentioned previously. For the purpose of this note we avoid the DAS team's fundamental valuation inputs and assumptions prejudicing the results and we do not attach the team's actual valuation estimates to the sampled history of exchange rates and market prices. Instead, we employ a simple log-linear trend regression to impute from each price history a stable equilibrium level against which we test the efficacy of reversion.

Fundamental value for currencies is defined by their real exchange rate (purchasing power). Therefore, the exchange rate histories were converted from nominal to real exchange rates by backing out differential inflation (one country's historical inflation less the other's) from

the nominal series. In real exchange rate space, the equilibrium exchange rate that we impute from the data—the unbiased proxy for fundamental value—should be a stationary constant level. We estimate the fundamental value proxy such that the sum of the squares of the discrepancies between price and value is minimized.

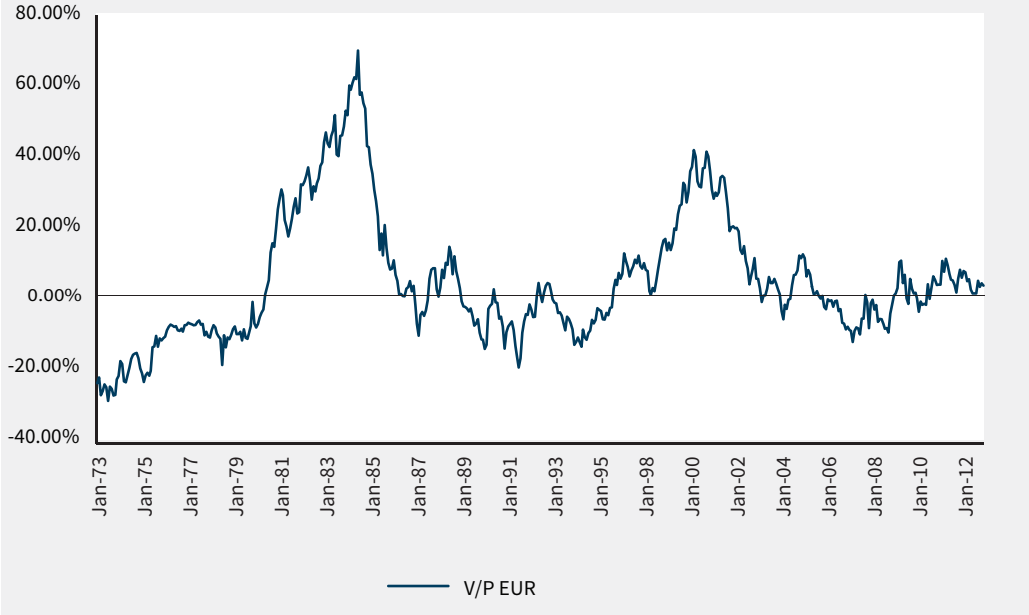
Similarly to currency, we proxy value for asset markets (i.e., bond and equity markets) by minimizing the square of the differences between the log of the price and the log of the value and assume value is growing at constant growth rate. The charts below show an example of price (real exchange rate) and value for the euro/U.S. dollar history, and the resulting value/price discrepancy over the same history:

Fig. 1: Price and Value for Euro vs. U.S. Dollar



Source: William Blair & Company

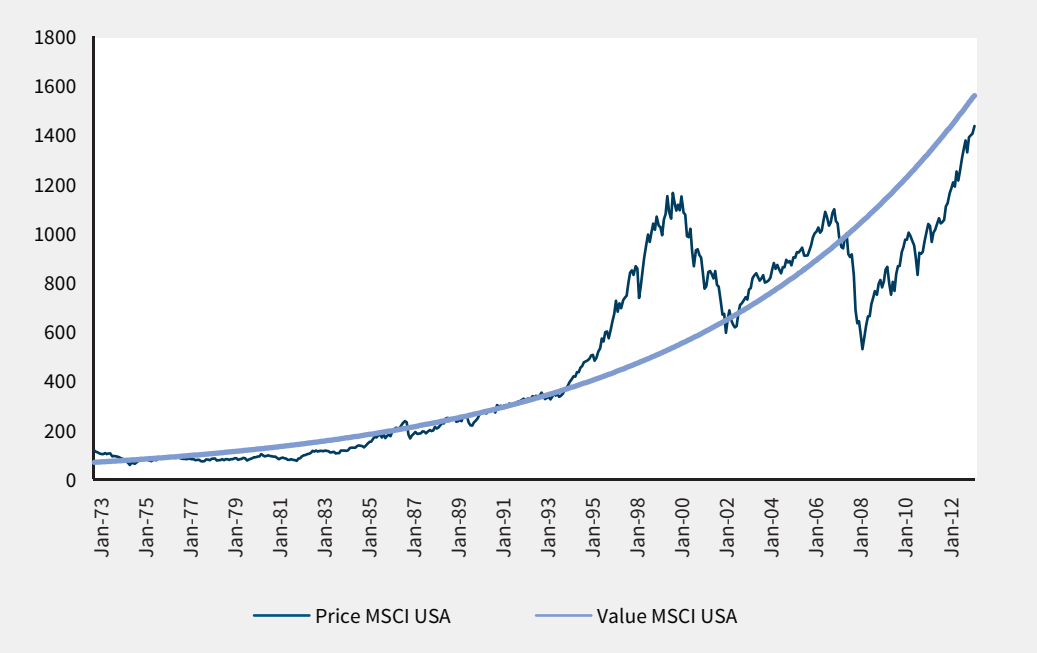
Fig. 2: Value/Price Discrepancy for Euro vs. U.S. Dollar



Source: William Blair & Company

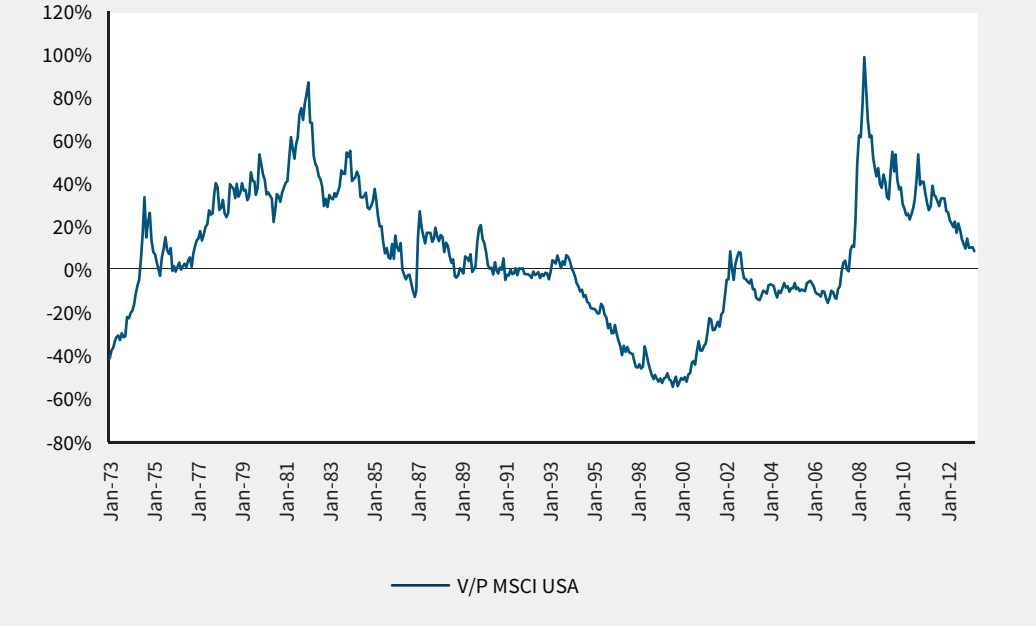
The charts below show an example of price and value (constant real growth trend) for the U.S. equity market, and the resulting value/price discrepancy over the same history:

Fig. 3: Price and Value for MSCI USA



Source: William Blair & Company

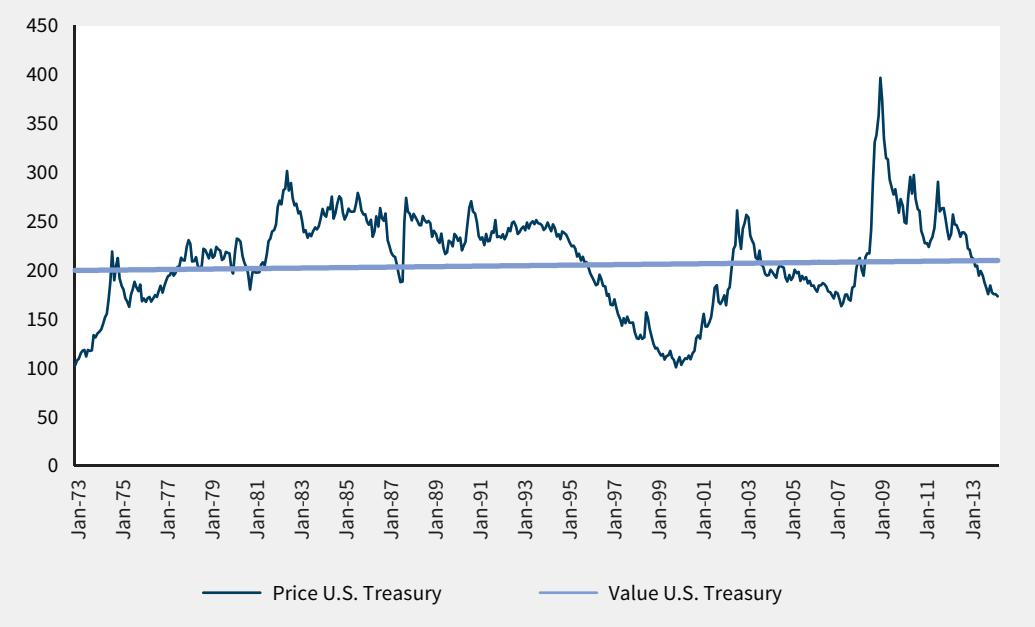
Fig. 4: Value/Price Discrepancy for MSCI USA



Source: William Blair & Company

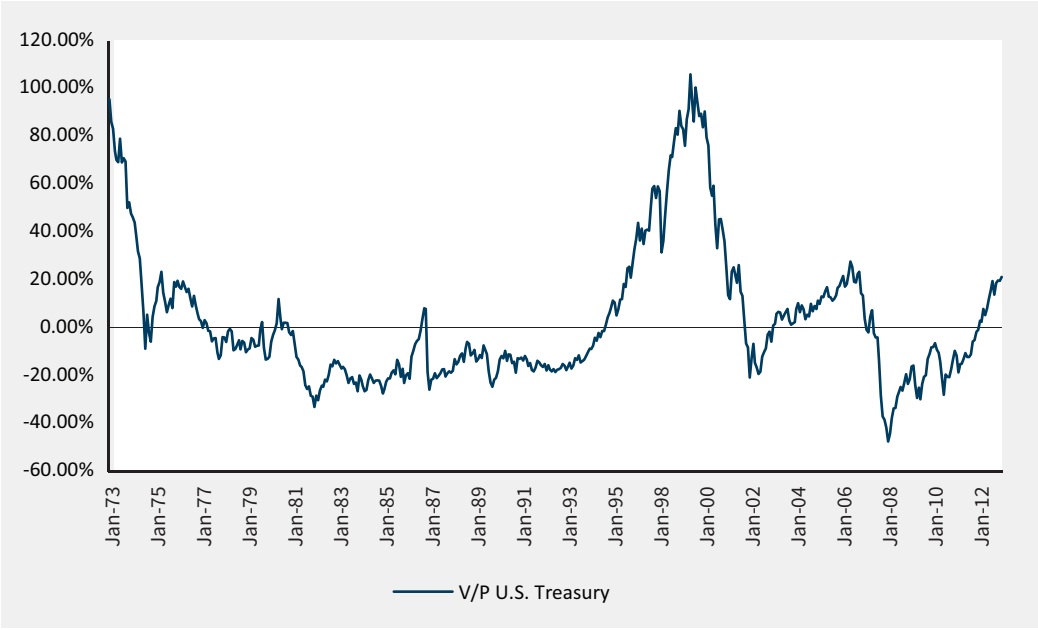
The charts below show an example of price and value (constant real growth trend) for the U.S. Treasury bond market, and the resulting value/price discrepancy over the same history:

Fig. 5: Price and Value for U.S. Treasury



Source: William Blair & Company

Fig. 6: Value/Price Discrepancy for U.S. Treasury



Source: William Blair & Company

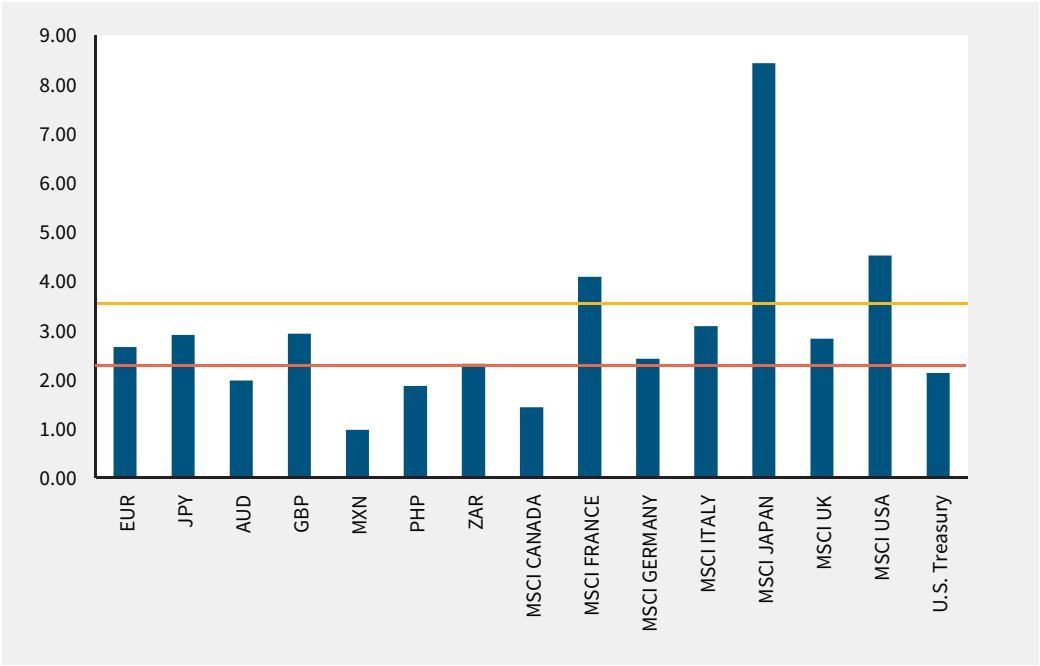
With price, fundamental value (or an unbiased proxy thereof), and discrepancy between price and value, we are thus equipped to test the efficacy of reversion of price to value.

Half-Life

In the context of discrepancies between price and value, the half-life is a statistical measure of the time required for the discrepancy to contract by half of its starting value. At any point in a price history, the half-life is therefore an expected horizon over which 50% of the reversion to value will occur.

We model the value/price discrepancy history with an autoregressive function of order one ("AR(1)") in which the series is described by the model as one in which random shocks (noise) produce non-zero value/price discrepancies, which then evolve with a single dependence on each value from the previous time period. The half-life estimate then gives the average time over which the value/price discrepancy decays to half its starting (shocked) level from each point in the history. The results of the half-life test, measured in years, are shown in the chart.

Fig. 7: Average Half Life of Currency and Asset Reversion of Price to Value (Years)



Source: William Blair & Company

In general, we find that the half-life of value/price discrepancies in currencies is shorter than it is in markets. The average half-life for the currencies investigated is 2.2 years (the red horizontal line in the chart above), and the average for the markets is 3.6 years (the orange horizontal line in the chart above). On the basis of these results there are grounds to assume that reversion is less slow in the case of currencies.

Probability of Reversion

For each historical series of value/price discrepancy in currencies and markets we can also compute the likelihood that, from any point in the history, price fully reverts to value or crosses it. We compute the probability of reversion for each series over one, two three, four, five and ten years. The results measured in percentage probability are shown in the table.

Fig. 8: Probability of Price Crossing Value vs. Time Horizon

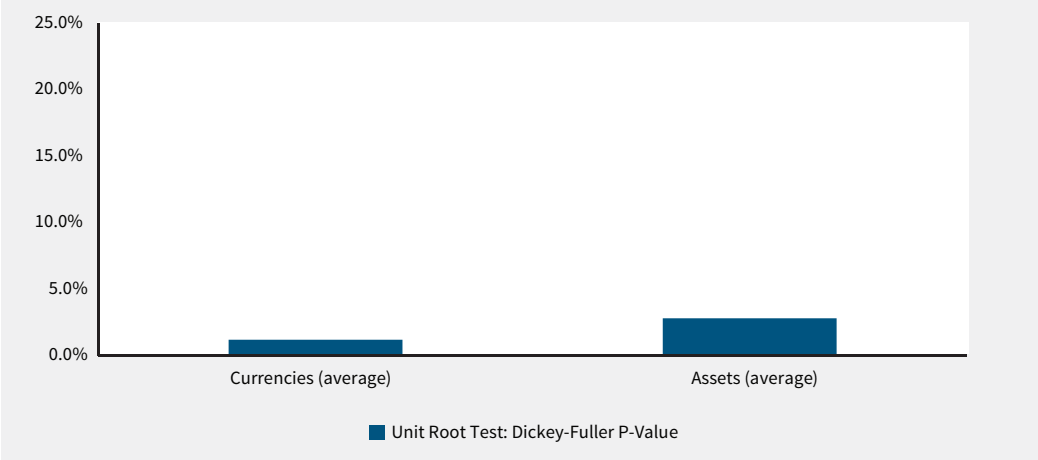
Probability of crossing Fundamental Value	Currencies (average)	Markets (average)
P(<1 Year)	33%	30%
P(<2 Year)	51%	48%
P(<3 Year)	64%	61%
P(<4 Year)	74%	71%
P(<5 Year)	82%	80%
P(<10 Year)	100%	97%

In general we find that the probability of currencies reverting to value (value/price discrepancy contracting to zero) is greater for any reversion horizon than the probability of markets reverting to value. These results also provide grounds for assuming that the probability of price reversion to value is higher for exchange rates than for asset markets, meaning reversion is faster in the case of currencies than it is for markets.

Stationarity of Fundamental Value

Since the previous two tests for half-life of value/price discrepancy and the probability of full correction of value/price discrepancy implicitly assume that fundamental value (real exchange rates for currencies and constant growth trend for equities) is stable over the history, it is instructive to also perform a test of this stability. This is an augmented Dickey-Fuller test for whether the autoregressive AR(1) model does or does not have a unit root. A p-value is obtained from the Dickey-Fuller test, which is the coefficient of unit root. If the p-value is close to zero, the null hypothesis that the series is not stationary can be rejected. If the p-value is closer to 50%, the series cannot be assumed to be stationary.

Fig. 9: Unit Root Test: Dickey-Fuller P Value



Source: William Blair & Company

In general, we find that the p-values are low, indicating a rejection of the null hypothesis that the series is not stationary. We also find that the p-values are lower for currencies than they are for markets. The average p-value for the currencies investigated is 1.2% and the average for equities is 2.8%. This suggests that currencies can be assumed to fluctuate around a stable fundamental value with slightly greater confidence than can be assumed for markets—although with both currencies and markets we can reject the hypothesis of non-stationarity with confidence.

Normal Distribution of Value/Price Discrepancies

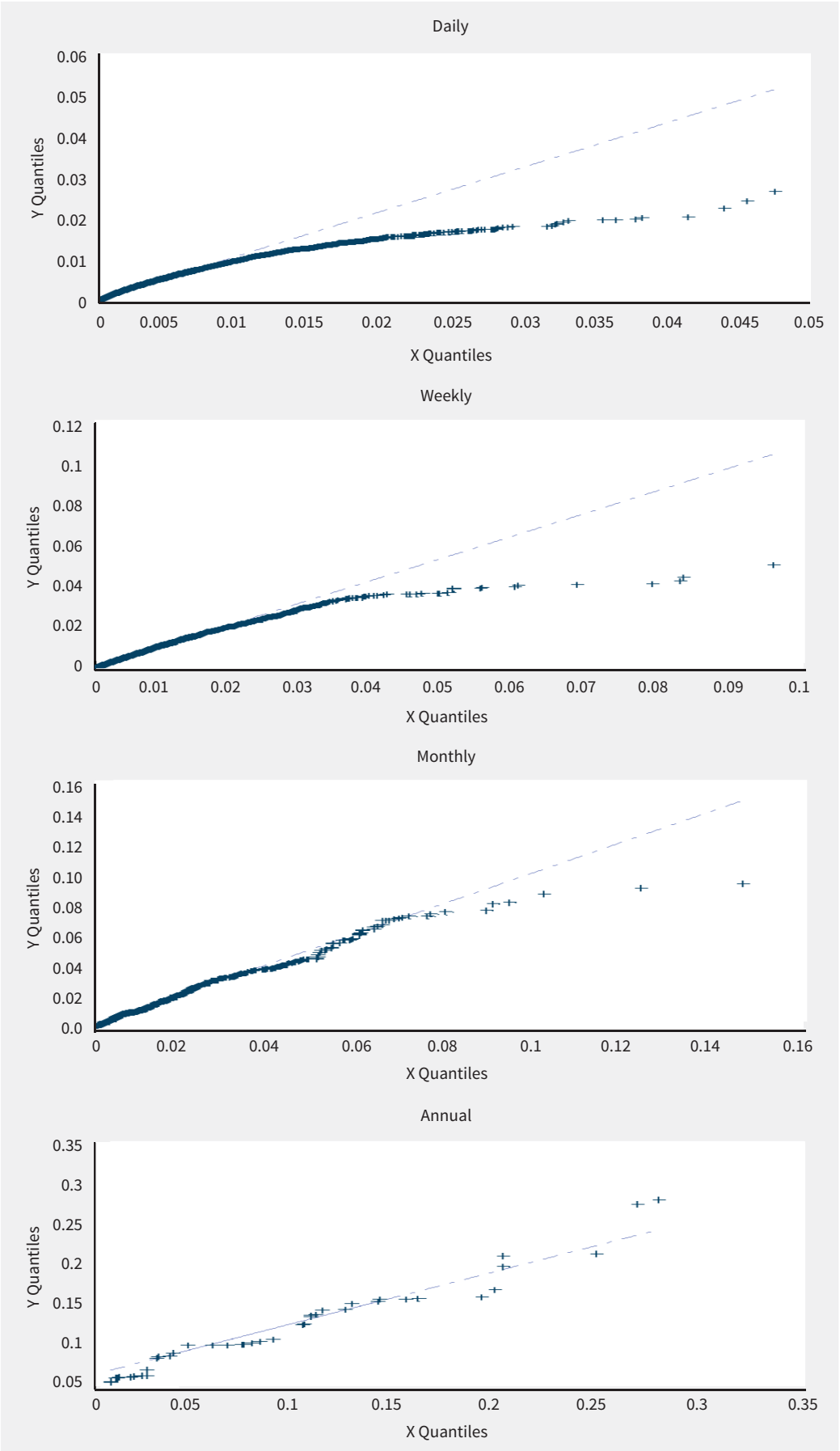
Lastly, it is often argued that investing in currencies creates tail risk as one is exposed to sudden short-term moves associated with devaluation and other currency crises. First, it is important to note that such crises are often beneficial to fundamental value investors as history shows that they frequently occur when central banks or governments try to maintain exchange rates significantly away from fundamental value, and the crises result in correction. Therefore, in most cases these crises create opportunities rather than risks for investors who invest based on fundamental value.

Nonetheless, financial market prices are generally believed to deviate from a normal distribution of price changes. In particular, they are believed to embody "fat tails", or a greater preponderance of outsized (large) movements than would be normally expected.

We do not seek to challenge this wisdom, but to evaluate the impact of non-normally distributed price changes over the time horizon with which we are typically concerned when considering reversion of price to value. As discussed previously, price-to-value reversion is not a short-run phenomenon, but one that occurs over periods of years rather than months, weeks, or days.

A quantile to quantile plot ("QQ plot") compares a given empirical distribution (such as the daily changes of the British pound/U.S. dollar exchange rate) to that of an equivalent normal distribution. On the X-axis we observe the empirical distribution of the absolute values of the series, on the Y-axis we observe the theoretical location of the quantile corresponding to each point in the empirical distribution. If the variable is normally distributed the quantiles will roughly align on the diagonal of the graph. Figure 10 shows the QQ plots for daily, weekly, monthly, and annual changes of the pound/dollar rate. These plots show that as the investment horizon lengthens, the QQ plots move closer to the diagonal and, therefore, exhibit less tail risk.

Fig. 10: Quantile-Quantile Plots of British Pound/U.S. Dollar Exchange Rate vs. Equivalent Normal Distribution



Source: William Blair & Company

We can confirm this characteristic by computing the shape of the probability, or Kurtosis, for the pound/dollar exchange rate changes computed over different horizons:

Fig. 11: Kurtosis of British Pound/U.S. Dollar Exchange Rate Changes

	Daily Returns	Weekly Returns	Monthly Returns	Annual Returns
Kurtosis	7.44	6.99	4.98	2.82

We find that as the time horizon is extended from daily changes through to semi-annual changes, there is a steady convergence of the actual series towards normality. We do not see perfect normality even at longer horizons but the progression is apparent. Regrettably more data to run the test for horizons longer than two years is not available. However, the indications are that, relevant to the time horizon over which reversion to value occurs (three to five years), price changes are significantly more normally distributed than at very short horizons, thus further validating the assumptions embedded in fundamental value investing.

Conclusion

This note challenges consensus wisdom that fundamental value is a less reliable concept for currencies than it is for asset classes. In addition, our results indicate that exchange rates tend to revert to value over slightly shorter time horizons than do asset markets. Additionally, we can draw reassurance that the non-normal distribution of exchange rate changes, which is apparent and widely recognized over very short horizons, is significantly attenuated in respect of the horizon over which price reversion to value is believed to occur.

These results argue for relatively more aggressive use of value/price investment signals in dynamic currency management than may be judged to be appropriate simply from the observation that the currency investment universe is narrower than the asset class investment universe available to top- down investors. It is this, coupled with the expectation of low correlation and large diversification benefits of managing currency in a top-down portfolio, which is the basis for the Dynamic Allocation Strategies team's long-standing decision to devote half of its portfolio's active risk to currency strategy and half to asset class/market strategy.

Important Disclosure

This material is provided for information purposes only and is not intended as investment advice nor is it a recommendation to buy or sell any particular security. Any discussion of particular topics is not meant to be comprehensive and may be subject to change. Data shown does not represent the performance or characteristics of any William Blair product or strategy. Any investment or strategy mentioned herein may not be suitable for every investor. Factual information has been taken from sources we believe to be reliable, but its accuracy, completeness or interpretation cannot be guaranteed. Past performance is not indicative of future results. Information and opinions expressed are those of the author and may not reflect the opinions of other investment teams within William Blair & Company, L.L.C.'s Investment Management division. Information is current as of the date appearing in this material only and subject to change without notice.