Currency Forwards in
Fixed Income Portfolio Analysis

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Contents

Introduction

Currency forwards developed rapidly in the late 1970s following the collapse of the Bretton Woods Agreement, a system for monetary and exchange rate management established in 1944. Subsequent to Bretton Woods, governments relaxed their currency controls. Variations in monetary policies resulted in exchange rates that became less coordinated and more volatile. That volatility created a need for hedging mechanisms to mitigate the currency risk associated with international transactions. Currency derivatives (including currency forwards and currency futures) offered banks, financial institutions, and multinational corporations a way to manage their foreign exchange risk. These derivatives allowed hedgers to "lock in" future exchange rates and speculators to execute strategies based on currency forecasts.

While portfolio administrators manage interest rate risk, volatility risk, or spread risk, currency managers seek to mitigate the effects of adverse changes in exchange rates. Currency hedgers and speculators have a variety of derivatives to choose from when managing exchange rate risk, including futures, options, swaps, and forwards. This paper focuses on currency forwards. Forward contracts are structured according to expiration date, contract size, and settlement procedures. Currency forwards are traded over the counter and carry counterparty risk; therefore, security deposits or compensating balances may be required by the counterparty. Currency forwards are widely traded in the U.S. and Europe and have become integral to the management of multi-currency bond portfolios.

This paper focuses on how FactSet accounts for currency forwards in fixed income portfolios and how currency forwards impact total return and performance attribution. To illustrate this, a sample portfolio is introduced and its risk exposures, total return, and performance attribution are analyzed, with and without currency forwards. In addition to total return and performance attribution, this paper explores FactSet analytics and data sources. Basic terms and conventions of currency forwards are also presented. FactSet's attribution model demonstrates how currency forwards impact the performance of a multi-currency bond portfolio relative to a multi-currency benchmark index.

Portfolio and Benchmark Example

The sample portfolio consists of multi-currency global bonds and is benchmarked against a multi-currency global index. For purposes of this example, EUR is the base currency and the reporting currency.

The sample portfolio includes approximately 85 securities, consisting of U.S. and European government and corporate bonds denominated in GBP, EUR, and USD. At the beginning of the analysis period, the portfolio was characterized by the parameters shown in Table 1.

Table 1: Portfolio Characteristics

	Percent	Yield to Maturity	OAS	Effective Duration	Spread Duration	Effective Convexity
Total	**100.00**	**2.72**	**131**	**5.17**	**5.30**	**0.64**
GBP	18.13	2.74	75	10.91	11.01	2.50
EUR	29.01	3.31	222	4.21	4.15	0.22
USD	52.86	2.38	102	3.72	3.98	0.24

The multi-currency benchmark used in this example is a custom index that includes GBP, EUR, and USD fixed rate bonds with final maturities of one year or longer and minimum par amounts outstanding of £200 million for GBP securities, €300 million for pan-European securities, and $300 million for USD securities. The benchmark excludes USD asset-backed, mortgage-backed, and other structured securities. The benchmark is summarized by the characteristics shown in Table 2.

Table 2: Benchmark Characteristics

	Percent	Yield To Maturity	OAS	Effective Duration	Spread Duration	Effective Convexity
Total	**100.00**	**1.68**	**57**	**5.16**	**5.28**	**0.55**
GBP	6.14	2.02	39	8.83	9.15	1.59
EUR	25.10	0.73	49	5.22	5.31	0.58
USD	68.76	2.00	62	4.81	4.92	0.45

The portfolio is compared to the benchmark in Table 3, which shows the relative exposures. The portfolio has a higher allocation to GBP (11.99%) and EUR (3.91%), and a lower allocation to USD (-15.90%). On a weighted-average basis, the portfolio has higher yield to maturity and higher option-adjusted spread (OAS) than the benchmark. The effective duration, spread duration, and convexity of the portfolio each are greater than the benchmark, primarily due to the securities held in the GBP sector.

Table 3: Relative Characteristics

	Percent	Yield To Maturity	OAS	Effective Duration	Spread Duration	Effective Convexity
Total	**0.00**	**1.03**	**74**	**0.01**	**0.03**	**0.09**
GBP	11.99	0.72	36	2.08	1.86	0.91
EUR	3.91	2.58	173	-1.01	-1.16	-0.36
USD	-15.90	0.38	40	-1.09	-0.94	-0.21

In Table 3, you can infer several investment strategies based on the relative exposures. For instance, the portfolio's relative percentage allocations suggest that bonds denominated in GBP and EUR are favored at the expense of USD denominated securities. The overweight in GBP and underweight in USD result in portfolio currency risk, which for purposes of this paper, is assumed to be an unintended consequence of the investment strategies underlying those allocations. The relative effective durations suggest that GBP rates are expected to decline and EUR and USD rates are expected to rise. The relative spread durations suggest that GBP spreads are expected to contract, while EUR and USD spreads are expected to widen.

Against this backdrop of portfolio and benchmark exposures, and for purposes of introducing currency forwards into the portfolio, suppose that portfolio management decides to use currency forwards to hedge the currency risk. The currency forwards used to accomplish that objective are summarized in Table 4.

Table 4: Currency Forward Contracts

	Factset Symbol	Base Currency	Term Currency	Forward Term	Forward Exchange Rate*
GBP Currency Forward	FWD_GBP_EUR	Euro	British Pound	30 Days	1.2878
USD Currency Forward	FWD_USD_EUR	Euro	US Dollar	30 Days	0.8261

*Exchange rates are rounded to four decimal places

Table 4 illustrates the factors used by FactSet to model currency forward contracts. In this example, the forward contract term is 30 days and both contracts are written against the Euro (i.e., the base currency). In FactSet, forward exchange rates are interpolated to the expiration date. FactSet receives monthly closing (mid) forward rates from WM/Reuters daily at 4:00 p.m. GMT. Users can also provide their own forward rates that FactSet can use for interpolation.

Managing Currency Risk with Currency Forwards

As noted previously, the portfolio's currency risk results from being overweight in GBP (11.99%) and underweight in USD (-15.90%) versus the benchmark. The currency forward positions required to hedge the associated currency risk are based on the local market values corresponding to those percentage allocations and are summarized in Table 5.

Table 5: Portfolio Currency Forward Hedge Positions

	Portfolio Market Value (EUR)	Portfolio Over/Under Weight vs. Benchmark (%)	Portfolio Over/Under Weight vs. Benchmark (EUR)	30-Day Forward Exchange Rate *	Portfolio Over/Under Weight vs. Benchmark (Local)	Position To Be Hedged (Rounded To Nearest 100,000)
Total	**€ 175,037,734**	**0.00%**	**€ 0.00**	**--**	**--**	**--**
GBP	€ 31,734,341	11.99%	€ 20,987,024	1.2878	£16,296,255	£16,300,000
EUR	€ 50,778,446	3.91%	€ 6,843,975	1.0000	€ 0.00	€ 0.00
USD	€ 92,524,947	-15.90%	-€ 27,830,999	0.8261	-$33,688,034	-$33,700,000

*Exchange rates are rounded to four decimal places

Table 5 shows the over and underweights in percentage terms, base currency terms, and local terms. In local terms, the portfolio is overweight £16,296,255 in the GBP sector and is underweight $33,688,034 in the USD sector. These exposures give rise to the portfolio's currency risk and are the positions to be hedged. Rounding those amounts to the nearest 100,000, the portfolio manager hedges the portfolio's currency risk by shorting £16,300,000 GBP currency forwards and by going long $33,700,000 USD currency forwards. The hedge positions are summarized in Table 6.

Table 6: Currency Forward Hedge Positions

	Symbol	Base Currency	Term Currency	Portfolio Position	Portfolio Market Value (Term)	Forward Exchange Rate*	Portfolio Market Value (Base)
GBP Currency Forward	FWD_GBP_EURS	EUR	GBP	Short	-£16,300,000	1.2878	-€ 20,991,847
	FWD_EUR_GBPL	EUR	GBP	Long	£20,991,847	1.0000	€ 20,991,847
USD Currency Forward	FWD_USD_EURL	EUR	USD	Long	$33,700,000	0.8261	€ 27,840,885
	FWD_EUR_USDS	EUR	USD	Short	-$27,840,885	1.0000	-€ 27,840,885

*Exchange rates are rounded to four decimal places

As with all derivative exposures, including currency forwards, FactSet uses a notional exposure approach to represent the derivatives and measure portfolio impacts, including analytics, total returns, and attribution. By design, FactSet displays each currency forward as two separate positions, one to represent each of the currencies in the contract. The paired legs of a currency forward contract have an offsetting position of equal and opposite market value at contract initiation. As a result, the market value in the reporting currency of the combined positions "nets out" to zero at inception, and does not distort the total market value or security weights of the portfolio. Using this approach, currency forwards contribute to the portfolio's currency sensitivity without impacting its initial market value.

For example, consider the GBP currency forward in Table 6. The portfolio manager sells £16,300,000 (i.e., the term currency) for forward delivery 30 days later. At a forward exchange rate of 1.2878, this is equivalent to selling €20,991,847 (i.e. the base currency). To offset the base currency market value of that position, a second currency leg is paired with the first by purchasing the EUR forward against GBP. The notional quantity or shares of the second leg is set to the market value of first leg. In this example, the corresponding forward exchange rate is set to 1.00 because the long EUR position is in the same currency as the base currency. If a third unrelated currency was chosen as the base currency, the forward rate of the second leg would reflect the exchange rate of the EUR against that currency.

Each of the currency forwards, including the paired legs, is shown in the context of the total portfolio in Table 7 and Table 8. Table 7 shows the portfolio at inception and Table 8 shows the portfolio at expiration. Both tables include the short GBP currency forward, the long USD currency forward, and their respective offsetting positions. In Table 7, the currency forward's ending market value and weight is zero for the consolidated forward positions, indicating that the currency derivatives contribute to the currency sensitivity of the portfolio without affecting its initial market value. After contract inception, daily fluctuations in exchange rates cause P&L for the currency forward positions. This is illustrated in Table 8, which shows market values 30 days after inception.

Table 7: Portfolio Including Currency Forwards at Inception of Hedge

	Port. Ending Price	Port. Ending Price (Local)	Port. Ending Quantity	Port. Ending Market Value	Port. Ending Market Value (Local)	Port. Ending Weight
Total	--	--	--	**€ 175,037,734**	**197,912,639**	**100.00**
GBP	--	--	--	€ 31,734,341	24,636,248	18.13
EUR	--	--	--	€ 50,778,446	50,773,203	29.01
USD	--	--	--	€ 92,524,947	111,952,226	52.86
[Currency Forwards]	--	--	--	€ 0.00	10,550,962	0.00
Long	--	--	--	€ 48,832,732	54,691,847	27.89
FWD_EUR_GBPL	1.0000	1.0000	20,991,847	€ 20,991,847	20,991,847	11.99
FWD_USD_EURL	0.8261	1.0000	33,700,000	€ 27,840,885	33,700,000	15.90
Short	--	--	--	-€ 48,832,732	-44,140,885	-27.89
FWD_GBP_EURS	1.2878	1.0000	-16,300,000	-€ 20,991,847	-16,300,000	-11.99
FWD_EUR_USDS	1.0000	1.0000	-27,840,885	-€ 27,840,885	-27,840,885	-15.90

Table 8 shows that the currency forward ending market values in *local* terms remain unchanged; however, the currency forward market values in the *reporting* currency increased to €1,320,602. This occurred as a result of the changes in the GBP and USD exchange rates during the holding period.

Table 8: Portfolio Including Currency Forwards at Expiration of Hedge (30 Days After Inception)

	Port. Ending Price	Port. Ending Price (Local)	Port. Ending Quantity	Port. Ending Market Value	Port. Ending Market Value (Local)	Port. Ending Weight
Total	**--**	**--**	**--**	**€ 187,519,723**	**201,050,960**	**100.00**
GBP	--	--	--	€ 34,549,938	25,959,036	18.43
EUR	--	--	--	€ 51,285,017	51,285,017	27.35
USD	--	--	--	€ 100,364,166	113,255,945	53.52
[Currency Forwards]	--	--	--	€ 1,320,602	10,550,962	0.70
Long	--	--	--	€ 50,855,820	54,691,847	27.12
FWD_EUR_GBPL	1.0000	1.0000	20,991,847	€ 20,991,847	20,991,847	11.19
FWD_USD_EURL	0.8862	1.0000	33,700,000	€ 29,863,973	33,700,000	15.93
Short	--	--	--	-€ 49,535,218	-44,140,885	-26.42
FWD_GBP_EURS	1.3309	1.0000	-16,300,000	-€ 21,694,333	-16,300,000	-11.57
FWD_EUR_USDS	1.0000	1.0000	-27,840,885	-€ 27,840,885	-27,840,885	-14.85

From a macro perspective, changes in interest rates, spreads, and currency exchange rates each contribute to the portfolio's terminal value and its total return versus the benchmark. The next section of this paper examines how currency exchange rates and currency forward positions impact portfolio total returns.

FactSet Total Return Calculations

The total return of a multi-currency bond portfolio includes currency return, price return, and coupon return. Changes in currency exchange rates affect all portfolio holdings that are not denominated in the base currency, including currency forward contracts. Currency forward contracts have notional market values equal to zero at inception, and then fluctuations in exchange rates cause the notional market value to increase or decrease over time, which gives rise to currency return. Table 9 shows the forward and spot exchange rates at the inception of the GBP and USD currency forwards, and spot rates at expiration.

Table 9: Forward and Spot Exchange Rates

	Beginning Forward Rate*	Beginning Spot Rate*	Ending Forward Rate	Ending Spot Rate*
GBP Currency Forward (€/£)	1.2878	1.2886	N/A	1.3309
USD Currency Forward (€/$)	0.8261	0.8264	N/A	0.8862

*Exchange rates are rounded to four decimal places

The total return of currency forwards is determined by changes in the spot exchange rate relative to the forward rate specified by the contract. If the date in the report is equal to the initiation date of the currency forward, the user-supplied forward rate is used to value the currency forwards so that market values net to zero. On subsequent days, FactSet interpolates between forward rates at two poles, depending on the days to expiration of the contract. For instance, with less than 30 days until expiration, interpolation is between the 30-day forward rate and the spot rate. FactSet offers linear

and logarithmic interpolation to value currency forwards. If there are 55 days until contract expiration, Portfolio Analysis will interpolate between the 30-day forward rate and the 60-day forward rate. If there are 60 days until contract expiration, Portfolio Analysis will use the 60-day forward rate. In this paper, EUR is the base currency and the reporting currency, so the return of the currency forward at expiration is calculated as follows:

$$Currency\ Forward\ Total\ Return = \left(\frac{FX_e^{Spot}}{FX_b^{Fwd}} - 1\right) * 100$$

Where:

FX_e^{Spot} = Ending Spot Exchange Rate at Contract Expiration

FX_b^{Fwd} = Forward Exchange Rate Specified by Currency Forward Contract

Just as changes in exchange rates affect the notional value and total return of the currency forward contracts, they also affect the total return for all portfolio and benchmark securities that are denominated in term currencies. For example, changes in the EUR/USD and EUR/GBP exchange rates impact all USD and GBP securities.

For coupon paying securities, currency movements impact both the price and coupon return. In FactSet, price and coupon return are displayed in local currency terms, with any return attributable to currency movements reflected as currency return. FactSet calculates total, price, and coupon returns as follows:

$$Total\ Return = Price\ Return + Coupon\ Return$$

Price return is calculated as:

$$Price\ Return = \frac{(P_e - P_b)}{(P_b + AI_b)} * 100$$

Coupon return is calculated as:

$$Coupon\ Return = \frac{\big((AI_e + INC_e)\big) - AI_b}{(P_b + AI_b)} * 100$$

Where:

P_b = Beginning Price

P_e = Ending Price

AI_b = Beginning Accrued Interest

AI_e = Ending Accrued Interest

INC_e = Ending Coupon Cash Flow

For a multi-currency portfolio, a currency return is added to the total return equation as follows:

$$Total\ Return = Price\ Return + Coupon\ Return + Currency\ Return$$

In FactSet, currency return is calculated as follows:

$$Currency\ Return = Total\ Return(Report\ Currency) - Total\ Return(Local\ Currency)$$

Returning to the example, Table 10 shows the components of total return for the unhedged portfolio excluding currency forwards versus the benchmark. The reporting currency is EUR and the holding period is one month.

Table 10: Portfolio Returns Excluding Currency Forwards versus Benchmark

	Return Component				Total Returns And Contributions			Variation
	Port. Price return (local)	Port. Coupon return (local)	Port. Currency return	Port. Total return (EUR)	Port. Contribution to return (EUR)	Benchmark total return (EUR)	Benchmark contribution to return (EUR)	Total return (EUR)
Total	**1.90**	**0.24**	**4.51**	**6.65**	**6.65**	**7.21**	**7.21**	**-0.56**
GBP	5.32	0.35	3.47	9.14	1.66	7.94	0.48	1.20
EUR	0.81	0.35	0.00	1.16	0.34	1.49	0.37	-0.33
USD	1.33	0.15	7.34	8.82	4.65	9.24	6.36	-0.42

As Table 10 illustrates, the portfolio's total return is 6.65%, compared to the benchmark's total return of 7.21%, which represents a variation of -0.56%. Price returns are positive across the currency sectors and the currency returns show that both term currencies appreciated against the base currency.

Continuing with the example, the portfolio's currency risk is hedged by selling a currency forward on GBP (-£16,300,000) and purchasing a currency forward on USD (+$33,700,000). The total returns of the hedged portfolio including the forwards are recalculated and shown in Table 11.

Table 11: Portfolio Returns Including Currency Forwards versus Benchmark

|	Return Component				Total Returns And Contributions			Variation
	Port. Price return (local)	Port. Coupon return (local)	Port. Currency return	Port. Total return (EUR)	Port. Contribution to return (EUR)	Benchmark total return (EUR)	Benchmark contribution to return (EUR)	Total return (EUR)
Total	**1.89**	**0.24**	**5.28**	**7.41**	**7.41**	**7.21**	**7.21**	**0.20**
GBP	5.32	0.35	3.47	9.14	1.66	7.94	0.48	1.20
EUR	0.81	0.35	0.00	1.16	0.34	1.49	0.37	-0.33
USD	1.33	0.15	7.34	8.82	4.65	9.24	6.36	-0.42
[Currency Forwards]	--	--	1.35	1.35	0.76	--	--	1.35
Long	--	--	4.14	4.14	1.16	--	--	4.14
FWD_EUR_GBPL	--	--	0.00	0.00	0.00	--	--	0.00
FWD_USD_EURL	--	--	7.27	7.27	1.16	--	--	7.27
Short	--	--	-1.43	-1.43	-0.40	--	--	-1.43
FWD_GBP_EURS	--	--	3.35	3.35	-0.40	--	--	3.35
FWD_EUR_USDS	--	--	0.00	0.00	0.00	--	--	0.00

The overall portfolio return increased from 6.65% to 7.41% and the difference increased from -0.56% to 0.20% relative to the benchmark. On a consolidated basis, the currency forwards returned 1.35% and contributed 0.76% to the total return of the portfolio. The benchmark does not include currency forwards and therefore, there are no values shown in the benchmark columns. The decision to hedge the currency risk with currency forwards appeared to pay off. It increased the absolute and relative returns by about 75 basis points, but how? To answer this question, we turn to benchmark-relative performance attribution.

Attribution of Portfolio and Benchmark Returns

FactSet's benchmark-relative performance attribution model explains performance based on portfolio exposures relative to the benchmark, factors of attribution, and changes in market conditions. FactSet allows you to choose the attribution factors and how the results are displayed. This paper describes a version of the model, in which the factors of attribution include shift, twist, spread, allocation, selection, and currency factors.

The relationship between portfolio strategy variables and the factors of attribution is illustrated in Figure 1, which shows one configuration of FactSet's attribution model.

Figure 1: FactSet Performance Attribution Model
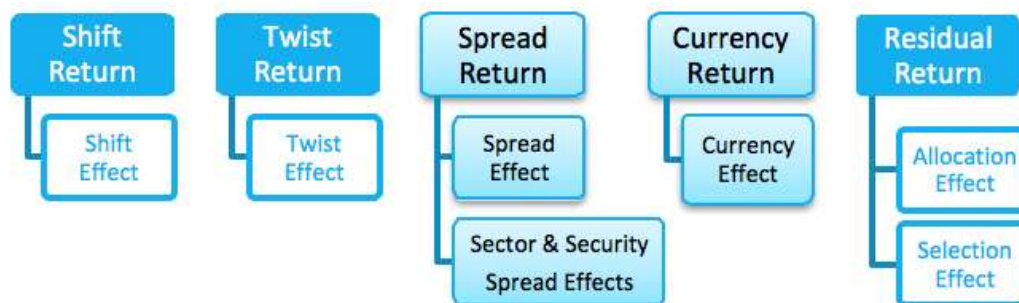
The most important attribution factor for currency forwards is the currency factor. However, FactSet also provides users with the option to include shift, twist, and spread returns for currency forwards. FactSet can generate fixed income analytics for currency forwards based on the modeling terms provided by users. These analytics allow currency forwards to have fixed income attribution effects such as shift, twist, and spread. For a full explanation of FactSet's attribution methodology, reporting configurations, and calculation details, see "*A Flexible Benchmark Relative Method of Attributing Returns for Fixed Income Portfolios*."[1] One advantage of FactSet's approach is that a common methodology and set of calculations are used for all types of securities and derivatives, including currency forwards.

FactSet's attribution model calculates the attribution effects for all securities in the portfolio and benchmark. Each of the factor components is described below.

For securities that are interest rate sensitive, shift return is calculated as:

$$Shift\ Return = -1 * E_{Duration} * \Delta_{Shift\ Point} + \frac{1}{2} * E_{Convexity} * \left(\Delta_{ShiftPoint}\right)^2$$

Twist return can be calculated in one of two ways:

$$Twist\ Return = -1 * E_{Duration}\left(\Delta_{DMT} - \Delta_{ShiftPoint}\right)$$

or

$$\left(-1 * E_{PartialDuration1} * \left(\Delta_{PartialPoint1} - \Delta_{ShiftPoint}\right)\right)$$

$$+ \left(-1 * E_{PartialDuration2} * \left(\Delta_{PartialPoint2} - \Delta_{ShiftPoint}\right)\right)$$

$$+ \left(-1 * E_{PartialDuration3} * \left(\Delta_{PartialPoint3} - \Delta_{ShiftPoint}\right)\right)$$

$$\ldots$$

$$+ \left(-1 * E_{PartialDurationN} * \left(\Delta_{PartialPointN} - \Delta_{ShiftPoint}\right)\right)$$

Where:

$E_{Duration}$ = Effective Duration

$\Delta_{ShiftPoint}$ = Change in the Yield of a User – Defined Yield Curve Shift Point

$E_{Convexity}$ = Effective Convexity

Δ_{DMT} = Change in the Rate of a Duration-Matched Government Bond

$E_{PartialDuration\#}$ = Effective Partial Duration at a Specific Yield Curve Point

$\Delta_{PartialPoint\#}$ = Change in Yield of a Specific Yield Curve Point

1 Kwasniewski, Stanley J., CFA 2013. "A Flexible Benchmark- Relative Method of Attributing Returns for Fixed Income Portfolios". http://www.factset.com/websitefiles/PDFs/whitepapers/fixed-income-model.

Shift and twist return represent the portion of total return explained by changes in the level and shape of the yield curve. Shift and twist returns exclude spread and carry components and are calculated independently of the benchmark. Effective duration is the default duration used to calculate shift and twist returns because it's the most commonly used measure of interest rate sensitivity for all security types, including those with embedded options. FactSet's fixed income attribution model also allows users to specify that modified, coupon curve, or partial durations be used instead of effective durations. The duration type selected has a direct impact on the shift and twist returns that the model produces. For more information, see *"A Flexible Benchmark Relative Method of Attributing Returns for Fixed Income Portfolios."*

For securities, including bonds and derivatives that are sensitive to credit spreads, spread return is calculated as:

$$Spread\ Return = -1 * S_{Duration} * \Delta_{OAS}$$

Where:

$S_{Duration}$ = Spread Duration

Δ_{OAS} = Change in Option Adjusted Spread

Residual return is calculated as:

$$Residual\ Return = Total\ Return - (Shift\ Return + Twist\ Return) - Spread\ Return - Curreny\ Return$$

Residual return represents the leftover portion of total return after factoring out interest rate, spread, and currency exchange rate components. Residual return includes income, carry (accretion and rolldown), volatility, and inflation. In FactSet, users have the option to extract each of these factors from residual return and isolate them as individual return components. Residual return is used to quantify allocation and selection effects, both of which are calculated relative to the benchmark, as follows:

$$Allocation\ Return = \sum_i [(W_i - \overline{W_i}) * (\overline{ER_i} - \overline{ER})]$$

$$Selection\ Return = \sum_i [W_i * (ER_i - \overline{ER_i})]$$

Where:

W_i = Weight of Sector i in Portfolio

$\overline{W_i}$ = Weight of Sector i in Benchmark

$\overline{ER_i}$ = Excess Return of Sector i in Benchmark

$\overline{ER}$ = Excess Return of Benchmark

ER_i = Excess Return of Sector i in Portfolio

Returning to the portfolio example, Table 12 shows performance attribution for the unhedged portfolio relative to benchmark and Table 13 shows similar data for the hedged portfolio.

Table 12: Attribution of Portfolio Excluding Currency Forwards versus Benchmark

	Non-Local Returns							Attribution			
	Variation Beginning Weight (Port. - Bench.)	Port. Total Return	Bench. Total Return	Variation in Total Return	Shift Effect (Local)	Twist Effect (Local)	Spread Effect (Local)	Allocation Effect (Local)	Selection Effect (Local)	Total Currency Effect	Total Effect
Total	**0.00**	**6.65**	**7.21**	**-0.56**	**-0.67**	**0.11**	**0.54**	**0.02**	**0.21**	**-0.77**	**-0.56**
GBP	11.99	9.14	7.94	1.20	0.44	0.21	0.01	0.03	0.03	-0.23	0.49
EUR	3.91	1.16	1.49	-0.33	-0.03	-0.12	0.13	-0.01	-0.01	-0.21	-0.25
USD	-15.90	8.82	9.24	-0.42	-1.08	0.02	0.40	0.00	0.19	-0.33	-0.80

The unhedged portfolio returned 6.65%, 0.56% less than the benchmark's return of 7.21%. As the attribution in Table 12 illustrates, most of the portfolio's underperformance was due to the shift and currency effects. These negative effects were partially offset by positive results related to the spread and selection factors.

We can compare results by adding the currency forwards to the portfolio and recalculating the attribution. Table 13 reports the relative performance attribution of the hedged portfolio, where the currency forwards are displayed in a group by themselves. Table 14 shows similar data where the currency forwards are grouped in the relevant currency bucket (i.e., GBP currency forward in the GBP sector, USD currency forward in the USD sector, and the currency forward offset positions in the EUR sector). Comparing Table 12, Table 13, and Table 14 highlights the impact of the currency forwards.

Table 13: Relative Attribution Including Currency Forwards (Forwards Grouped Separately)*

	Non-Local Returns							Attribution			
	Variation Beginning Weight (Port. - Bench.)	Port. Total Return	Bench. Total Return	Variation in Total Return	Shift Effect (Local)	Twist Effect (Local)	Spread Effect (Local)	Allocation Effect (Local)	Selection Effect (Local)	Total Currency Effect	Total Effect
Total	**0.00**	**7.41**	**7.21**	**0.20**	**-0.67**	**0.11**	**0.54**	**0.02**	**0.21**	**-0.01**	**0.20**
GBP	11.99	9.14	7.94	1.20	0.44	0.21	0.01	0.03	0.03	-0.23	0.49
EUR	3.91	1.16	1.49	-0.33	-0.03	-0.12	0.13	-0.01	-0.01	-0.21	-0.25
USD	-15.90	8.82	9.24	-0.42	-1.08	0.02	0.40	0.00	0.19	-0.33	-0.80
[Currency Forwards]	0.00	1.35	--	1.35	--	--	--	0.00	--	0.76	0.76
Long	27.89	4.14	--	4.14	--	--	--	-0.08	--	-0.28	-0.36
FWD_EUR _GBPL	11.99	0.00	--	0.00	--	--	--	-0.03	--	-0.61	-0.64
FWD_USD _EURL	15.90	7.27	--	7.27	--	--	--	-0.05	--	0.33	0.28
Short	-27.89	-1.43	--	-1.43	--	--	--	0.08	--	1.04	1.12
FWD_GBP _EURS	-11.99	3.35	--	3.35	--	--	--	0.03	--	0.23	0.26
FWD_EUR _USDS	-15.90	0.00	--	0.00	--	--	--	0.05	--	0.81	0.86

*You can include shift, twist and spread effects for currency forwards once modeling is provided and fixed income analytics are generated. In this scenario, the portfolio manager is executing a currency overlay strategy, so fixed income analytics are not generated for the currency forwards because they are not part of the overall fixed income strategy.

Table 14: Relative Attribution Including Currency Forwards (Forwards Grouped with Currencies)

	Non-Local Returns							Attribution			
	Variation Beginning Weight (Port. - Bench.)	Port. Total Return	Bench. Total Return	Variation in Total Return	Shift Effect (Local)	Twist Effect (Local)	Spread Effect (Local)	Allocation Effect (Local)	Selection Effect (Local)	Total Currency Effect	Total Effect
Total	**0.00**	**7.41**	**7.21**	**0.20**	**-0.67**	**0.11**	**0.54**	**0.00**	**0.23**	**-0.01**	**0.20**
GBP	0.00	4.13	7.94	-3.81	0.44	0.21	0.01	0.00	0.10	-0.01	0.75
EUR	0.00	0.59	1.49	-0.90	-0.03	-0.12	0.13	0.00	-0.01	0.00	-0.03
USD	0.00	8.46	9.24	-0.78	-1.08	0.02	0.40	0.00	0.14	0.00	-0.52

Table 13 and Table 14 indicate that the total return of the hedged portfolio increased from 6.65% to 7.41% and the total currency effect increased from -0.77% to -0.01%. Comparing Table 13 and Table 14, the first column in Table 14 shows that the inclusion of the currency forwards eliminates the currency over and underweights of the unhedged portfolio, resulting in the hedged portfolio being sector neutral relative to the benchmark. As a result, the allocation effect displayed in Table 14 is equal to zero for each currency sector.

You can also see the impact of the currency forward positions graphically by plotting the exchange rates during the holding period, which is shown in Figure 2.

Figure 2: Spot Exchange Rates

As Figure 2 illustrates, the USD and GBP exchange rates appreciated against the EUR. As a result, the currency forwards returned 1.35% on a consolidated basis and contributed 0.76% to the total return of the portfolio. The forwards effectively offset the negative currency impact that resulted from the portfolio's currency over and underweights relative to the benchmark.

Summary and Conclusions

Currency forwards are commonly used by traders and portfolio managers to hedge currency risk in multi-currency bond portfolios. As with all derivative exposures, FactSet applies a notional exposure approach to measure currency forwards and their impact on portfolio performance. FactSet displays each currency forward as two separate positions, one to represent each of the currencies in the contract. At inception, the market value in the reporting currency of the combined positions "nets out" to zero and does not distort the total market value or security weights of the portfolio. Currency forwards thereby contribute to a portfolio's currency sensitivity and only impact its market value via their daily profit and loss. The analytics and returns calculated by FactSet constitute the basis for calculating benchmark-relative performance attribution for portfolios that include currency forwards.