THE EQUITY DIFFERENTIAL FACTOR IN CURRENCY MARKETS

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Abstract

We show that the differential in trailing equity market performance across countries strongly predicts the cross section of currency returns. Specifically, exchange rates tend to appreciate for countries that have had the strongest equity returns in the preceding year. Implementable portfolios formed on this equity differential factor generated a return-to-risk ratio superior to the traditional carry, trend, and valuation-reversion factors in currencies since 1990. The equity differential factor cannot be explained by these traditional strategies, and produces a statistically significant alpha in excess of them. Moreover, the factor has performed remarkably consistently over time, including in recent years, and it is robust to many different formulations. We conjecture that marginal investor demand for outperforming equity markets might contribute to this effect.

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The interest rate differential between two countries is a strong predictor of the future profits that result from a bet on their exchange rate. On average, spot exchange rates have failed to converge to the interest rate differentials implied by forward rates. This phenomenon is known as the forward rate bias, and it underpins the historically profitable carry trade. The carry trade is implemented by entering into forward contracts to buy currencies with high interest rates and sell currencies with low interest rates. The total return of the trade equals the interest rate differential earned plus the return associated with any change in the spot exchange rate. Although there is no consensus on why exactly the carry trade works, there are two general possibilities. One is that interest rates adjust to compensate investors for the inherent riskiness of certain currencies. The other is that spot exchange rates rise more (or fall less) for countries with high interest rates, perhaps because they attract more investment or because they adjust to deliver a risk premium to investors. Either effect may lead to positive average carry returns.[1]

In this paper, we construct an investment strategy that is conceptually similar to the carry trade, however we do not use interest rates. Instead, we determine currency positions based on trailing 12-month equity index returns for each country. It is important to note that this strategy does not actually invest in any equities. It uses equity index returns merely to indicate which currency positions to take. This “equity differential” strategy is implemented by entering into forward contracts to buy currencies associated with high recent equity returns

and sell currencies associated with low recent equity returns. Just like the carry trade, the equity differential strategy generates a return that equals the interest rate differential earned plus the return of the spot rate. The interest rate differential is an unavoidable feature of speculation in currency forward contracts, but since we are not selecting currencies based on their interest rate differentials this component of return is likely to be small. The spot return is more relevant. We find that currencies associated with high recent country equity returns subsequently outperform those with low equity returns. This result is surprisingly consistent and robust.

We noted earlier that carry factor returns may arise because interest rates adjust up for riskier currencies, or because their exchange rates tend to appreciate. We can apply the same logic to the equity differential factor. Suppose that long-run equity premiums are higher for some countries due to their inherent risk. Those countries will reward equity investors with higher local returns. How will they affect currency returns? To the extent that currency risk and country equity risk are related, we might expect to see higher interest rates in the riskier country. This would imply that the equity differential strategy is correlated to carry. However, we find that the two strategies are almost perfectly uncorrelated. What about the exchange rate story? The notion that spot rates increase due to high relative demand for a country's assets follows the same logic whether those assets are short term interest bearing instruments or equities. Either one could increase the value of the currency. In the case of equities, this view implies that investor demand for equities is – either rationally or irrationally – partly based on recent performance. This seems plausible given the strong empirical support for equity

momentum. Moreover, we find that the equity differential strategy cannot be explained by currency momentum.

To the best of our knowledge, the equity-based currency factor we introduce has not been documented previously in the literature. Research in currency pricing and prediction has focused mostly on the interest rate differential, fair value equilibrium with Purchasing Power Parity, and time series trends of exchange rates. More commonly, a country's exchange rate is considered as an input to explain or predict its equity market performance, and not the other way around. Hau and Rey (2006) estimated the contemporaneous correlation of foreign currencies and equities to be negative from a US investor's perspective. However, these results may be highly specific to the US dollar given its status as a global reserve and safe-haven currency (see for example Lustig et al (2014)). Furthermore, the relationships we find are not contemporaneous but occur in a lead-lag fashion from equities to currencies. Research has only recently begun to document a meaningful predictive link between country fundamentals and pairwise currency performance. Colacito et al (2018) show that the difference in output gap, as a measure of relative economic conditions and the business cycle across countries, is predictive of future currency returns. Djeutem and Dunbar (2018) extend the notion of uncovered interest rate parity in currencies to uncovered "return parity" wherein the prospects of equity return and bond yields may both drive marginal demand for a currency. Our results are consistent with both of these papers and build upon this stream of research in three key ways. First, we show that widely available market prices of major equity indices can be used in an extremely simple manner to generate currency returns that are associated with local market and economic

conditions across countries. Second, we focus our application on the large and liquid G10 developed market currency universe and apply a pairwise algorithm for implementable portfolio construction that applies to currency investors from any domicile. Third, we present results for a variety of practical formulations of the equity differential factor and find that it is remarkably robust over time and to changes in parameters and construction.

We structure the remainder of the paper as follows. First, we form portfolios based on the equity differential factor and relate its performance to other known currency factors. Next, we present panel regressions of currency returns on equity differentials to further explore cross sectional pricing relationships. The last section concludes.

The Equity Differential Factor

We apply the approach from Czasonis et al (forthcoming) to create cross sectional currency portfolios that are base currency agnostic. We analyze the G10 currency universe which includes the Australian dollar, Canadian dollar, Swiss franc, Euro, British pound, Japanese yen, Swedish krona, Norwegian krone, New Zealand dollar, and US dollar.[2] To construct the equity differential factor portfolio through time, we proceed as follows. At the end of each month, we:

1. Identify all 45 currency pairs comprised of the G10 currencies.
2. Calculate the differential in trailing 12-month equity index total returns, denominated in local currency units, as of the end of the previous month for each pair.

3. Re-orient (flip) each currency pair to represent a positive equity differential.
4. Allocate equal weight to each pair (or, alternatively, for a subset of pairs with the largest size differential) and net the currency exposures across pairs to arrive at a final set of currency weights.
5. Record the subsequent month's performance of the factor portfolio, assuming implementation with one-month currency forward contracts.[3]
6. Move to the next month and repeat.

This method guarantees that our results are representative for any investor, rather than anchoring arbitrarily to a specific base currency. The pairwise approach also creates more nuanced portfolios than a simple ranking approach across the 10 currencies because some currencies may have more weight in the final portfolio than others after the pairwise positions are netted. We repeat the same portfolio construction process for the carry trade (ranking by interest rates), trend (ranking by the trailing 12-month currency spot return as of the end of the previous month) and value (ranking by the negative of the trailing 5-year currency spot return to reflect long-run mean reversion).[4]

Exhibit 1 shows the historical performance of the equity differential factor from January 1990 through December 2017. It has a higher return to risk ratio than any of the traditional strategies. Its risk, measured as annualized volatility, is lower in absolute terms than any of the other strategies, and it exhibits less downside risk as measured by the 5 percent worst outcomes. Its downside risk has been less severe than that of the other strategies, and its monthly returns do not exhibit any skewness. We also report the average annualized turnover

for each factor portfolio (selling the current portfolio and buying a completely different one equals a turnover of 1) as well as the breakeven cost, which is the combined percentage cost of a position change (buys plus sells) that would decrease the return of the strategy to zero. Trading costs are unlikely to erode the practical benefit of these strategies, as the G10 currency market is among the most liquid and highly traded markets in the world.

Exhibit 1: Factor Portfolio Performance (1990 – 2017)

	Carry	Trend	Value	Equity Differential
Return	2.1%	0.1%	1.5%	1.9%
Risk	4.0%	3.9%	3.8%	3.1%
Ratio	0.52	0.04	0.40	0.61
Hit Rate	62%	53%	55%	58%
Skewness	-0.75	-0.64	0.78	0.00
5% Worst Year	-5.2%	-5.2%	-4.7%	-2.7%
5% Worst Month	-2.0%	-2.0%	-1.5%	-1.3%
5% Best Month	1.7%	1.6%	1.8%	1.6%
5% Best Year	9.1%	5.5%	8.1%	6.1%
Annual Turnover	0.76	2.36	1.34	2.34
Breakeven Cost	2.76%	0.06%	1.12%	0.81%

Exhibit 2 shows each factor's cumulative returns. The equity differential factor is remarkably consistent in its performance over time. It is by far the most effective strategy in the recent sample after the 2008 financial crisis. Exhibit 3 shows that its correlation with other factors is low, on both the monthly and annual frequency.

Exhibit 2: Cumulative Returns

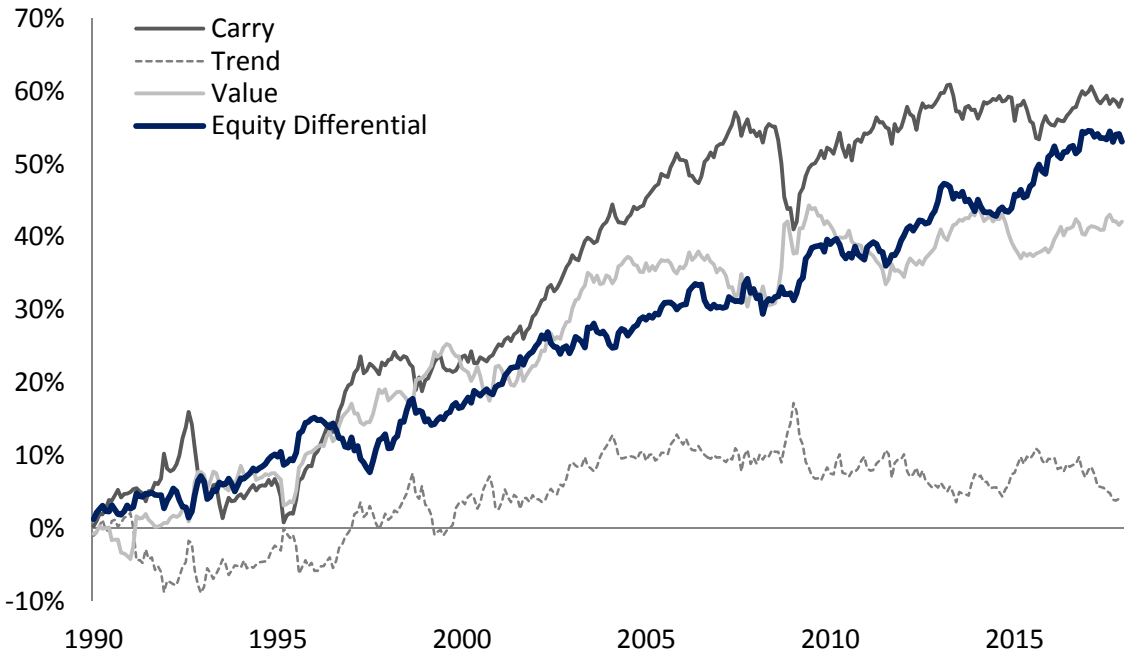


Exhibit 3: Return Correlations

	Monthly			Annual		
	Carry	Trend	Value	Carry	Trend	Value
Trend	0.01			-0.04		
Value	-0.09	-0.49		0.00	-0.20	
Equity Differential	-0.03	-0.22	0.19	-0.13	-0.29	0.12

Next, we regress the monthly returns for the equity differential factor on those of the other three factors. The R-squared of the regression is only 4 percent, and the annualized alpha is highly significant with a t-Statistic of 3.12. All of the other coefficients are close to zero, however the trend coefficient is negative and significant. This is an intriguing result, given that the equity differential factor reflects a type of momentum in relative equity returns, and the

trend factor represents a similar type of currency momentum. This result reveals that currencies with a positive equity differential do not tend to have a corresponding positive lagged currency return, which means the equity effect is distinct from the currency trend effect.

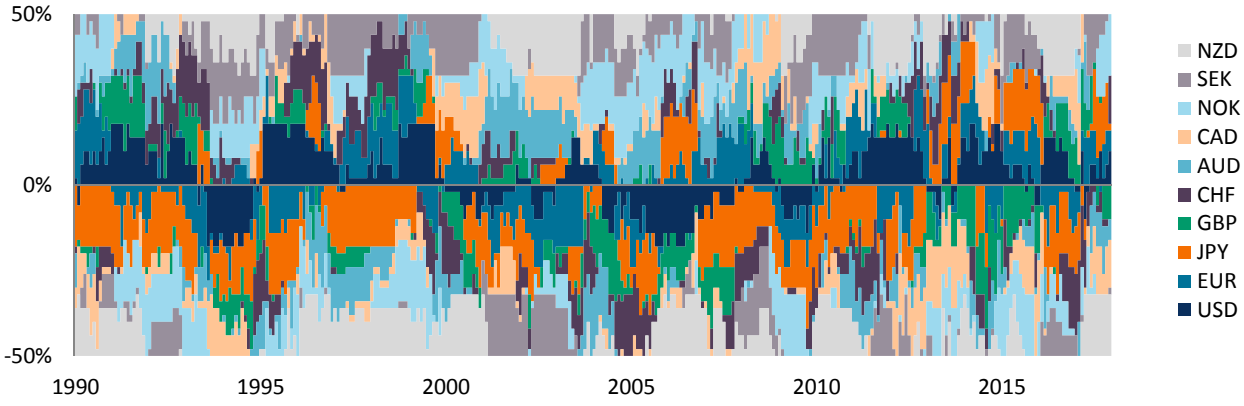
Exhibit 4: Regression of Equity Differential Factor Portfolio on Other Factors

	Intercept*	Carry	Trend	Value
Coefficient	1.8%	-0.02	-0.13	0.09
t-Statistic	3.12	-0.41	-2.64	1.73
R-Squared	0.06			

* Shown in annualized units; t-Statistic for intercept pertains to monthly data.

Exhibit 5 shows the portfolio weights for the equity differential portfolio after netting the pairwise exposures. By virtue of the pairwise construction method, the exposures are quite diversified across currencies. They exhibit clear multi-year trends but there are no inherent biases towards one currency or another.

Exhibit 5: Equity Differential Factor Portfolio Weights



Robustness Tests

We now explore some additional robustness tests for the factor. Exhibit 6 presents the results. Our base case equity differential factor includes all 45 currency pairs in the portfolio each month, and it uses a 12 month lookback window to compute the equity differential for each pair of countries. First, we vary the number of pairs included in the portfolio. Each currency is included in nine of the 45 pairs, so when we pick 27 there must be at least three different currencies in the long basket and the short basket. When we pick nine pairs, it is possible for one currency to comprise the entire long or short basket, but in that case the opposite basket must be diversified across the other nine currencies. We also test a version that selects the single pair with the largest equity differential. The strategy return rises as we select fewer pairs, which indicates that the signal becomes stronger in the tails. Of course, the resulting portfolios are also less diversified, so the volatility rises and in general, the return to risk ratio drops. Though we do not present the full robustness test results for carry, trend and value here, we computed them based on the same parameter specifications for comparison. In every case, the equity differential factor had the highest return to risk ratio. We also repeated the regressions from Exhibit 4 and we report the annualized intercept and its t-Statistic. The intercept comprises nearly all of the excess return of the factor in every case, which means it cannot be explained by the other factors. It becomes less significant due to higher noise in the more concentrated portfolios, but the t-Statistic remains above 2.0 even in the case of one pair.

Next, we vary the lookback window used to compute trailing country equity returns, while keeping the pair selection fixed at 45. The results do not change much when we use a six

or 18 month lookback instead of 12, though the performance is slightly stronger for the shorter window. Once again, in every instance the equity differential factor had a higher return to risk ratio than the carry, trend and value factors.

Exhibit 6: Robustness Tests

	Base case	Number of pairs			Lookback window	
	45 pairs, 12 months	27 pairs	9 pairs	1 pair	6 months	18 months
Return	1.9%	2.4%	3.6%	4.2%	2.1%	1.6%
Risk	3.1%	4.4%	6.5%	9.6%	3.4%	3.0%
Ratio	0.61	0.54	0.55	0.43	0.63	0.54
	Regressions against carry, trend and value					
Intercept (annualized)	1.8%	2.1%	3.1%	3.7%	2.0%	1.6%
t-Statistic	3.12	2.53	2.55	2.04	3.17	2.67

Panel Regressions

The results presented so far have been based on implementable portfolios formed on the information available at each point in time, assuming investment in one-month forward contracts. In this section, we analyze the predictive relationship between each of the pairwise currency variables underlying the factors and the next month's spot return for each currency pair. We perform this analysis as a panel regression that includes observations for each pair each month for a total of 15,075 observations from January 1990 to December 2017. We include various combinations of time fixed effects and currency pair fixed effects to evaluate the variables' predictions in the cross section and through time. Formulating the cross section with currency pairs has the benefit of increasing the number of observations, reflecting pairwise differences for each combination of countries, and avoiding any arbitrary anchor to a

specific base currency. However, it is very important to account for the fact that these observations are not independent from one another. Each currency is included in nine pairs, so the observations will be correlated across pairs by construction. This correlation does not bias the coefficient estimates, but it will bias the conventional estimates of standard errors if they are not adjusted. Thus, we compute standard errors and t-Statistics that adjust for the correlation of errors across every combination of currency pairs.

The regression results are shown in Exhibit 7. The equity differential is a positive and statistically significant predictor of future spot returns both in the cross section and through time. The interest rate differential is a weak negative predictor for the spot rate, which means that spot returns tend to be negative for higher interest rate currencies (the interest rate differential earned in the carry trade, which is not represented here, more than makes up for the losses in the spot return, which is why the carry trade works). Lagged 12 month currency returns are a weak positive predictor, and lagged five year currency returns are in general statistically significant and negative, representing a tendency for mean reversion in currency values. In the second regression, currency pair fixed effects account for much of the variation across pairs, so these results mostly pertain to the time series predictions of each variable. In the third regression, time fixed effects account for much of the variation across time (such as global risk conditions), so these results mostly pertain to the cross sectional predictions of each variable. The R-squared is substantially higher for the cross section.

Exhibit 7: Panel Regression Results (1990 – 2017)

Time fixed effects	No		No		Yes		Yes	
Currency pair fixed effects	No		Yes		No		Yes	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Equity differential	0.010	2.10	0.011	2.37	0.010	2.05	0.011	2.34
Interest rate differential	-0.282	-0.70	-0.013	-0.02	-0.273	-0.70	0.037	0.06
12m prior currency return	0.006	0.58	0.006	0.53	0.007	0.64	0.006	0.57
60m prior currency return	-0.010	-1.83	-0.012	-2.10	-0.010	-1.80	-0.012	-2.07
R-squared	0.79%		1.05%		8.60%		8.86%	

Conclusion

The cross section of currency returns has been studied far less than that of equities, and evidence of a strong link between the two markets is even more rare. Nevertheless, we find that the differential in recent equity market performance across countries offers a strong and consistent prediction of next month currency returns. This equity differential factor can be implemented easily and practically via ranked currency portfolios in developed markets. It is highly distinct from the traditional carry, trend and value factors that are commonly applied to currency investing and has outperformed them all in risk-adjusted terms since 1990.

Notes

We thank Megan Czasonis for helpful comments.

The material presented is for informational purposes only. The views expressed in this material are the views of the authors and are subject to change based on market and other conditions and factors; moreover, they do not necessarily represent the official views of State Street Global Exchange or State Street Corporation and its affiliates.

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[1] There is a very extensive literature on the carry trade and its possible explanations. For further discussion on these issues, see for example Hodrick and Srivastava (1984), Burnside (2012) and Dobrynskaya (2014).
[2] We use the German mark to proxy for the Euro prior to its introduction.
[3] We use the WM Reuters 4pm London mid rates for spot and one-month forward prices.
[4] We performed the analysis using a more precise definition of currency valuation using Purchasing Power Parity implied from spot returns and inflation rates. The two value/reversion factors are very similar and did not affect the results.