An Integrated Approach to Currency Factor Management

Ananthalakshmi Ranganathan[*,§] Harald Lohre[*,§] Houssem Braham[‡] Sandra Nolte[§]

*Invesco Quantitative Strategies
[§]EMP at Lancaster University Management School
‡ Solactive AG

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Motivation

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- Forecasting exchange-rates has always been an area of interest since late 1900's
- Currency forecasting is considered to be challenging as FX investments are assumed to be a zero-sum game
- Academic literature provides positive evidence on currency forecasts,for example, Mark [1995] and Mark and Sul [2001] find evidence in favour of long horizons forecasts
- We apply an asset allocation approach where we use predictive information based on time-series variables and cross-sectional currency characteristics in order to
  1. Time currencies
  2. Exploit currency factors
  3. Integrate the notion of factor timing
- We adopt the portfolio theoretic framework of Brandt and Santa-Clara [2006] and Brandt, Santa-Clara, and Valkanov [2009] that allows to jointly access the relevance of various potential predictors

Data

- We carry out the analysis from the perspective of an USD investor
- Our investment universe comprises the G10 currencies where the USD is the base currency
- This FX sample corresponds to the countries: Australia, Canada, Denmark, Germany, Japan, New Zealand, Norway, Sweden, Switzerland and the United Kingdom
- Our dataset spans from February 1990 to December 2016

Optimal Currency timing

Choice of time-series predictor variables

- Whether macroeconomic and financial variables could forecast asset returns is still widely debated
- Nevertheless, there is substantial evidence supporting the relevance of fundamental variables, interest-rate related variables and technical variables. So, we consider the following set for our analysis :

14 fundamental variables

- Valuation via dividend yield, price-earnings or book-to-market
- Interest rates, term spread, default spread
- Financial variables like market volatility, net equity issuance, etc.

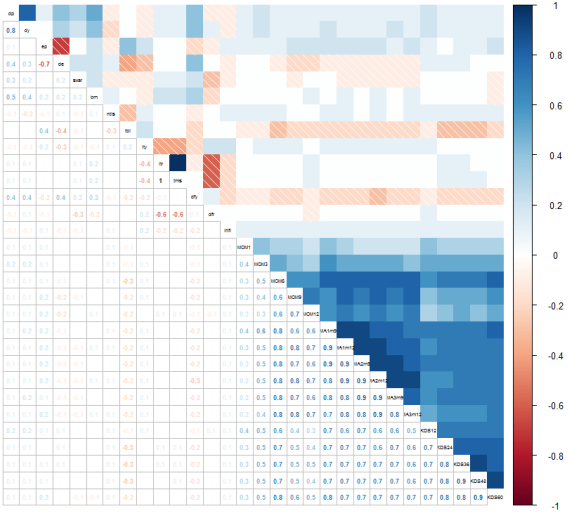
Goyal & Welch [2003, 2008]

16 technical indicators

- 6 moving averages:
  MA (1m-9m), ..., MA (3m-12m)
- 5 Stochastic Oscillators(KDS_m) indicators:
  KDS (12m), ..., KDS (60m)
- 5 time-series momentum indicators:
  MOM (1m),MOM (3m), ..., MOM (12m)

Hammerschmid & Lohre (2018)

Correlation matrix of predictor variables: the case of USD/EUR



Principal Component Analysis: the case of USD/EUR

- Fundamental and technical variables are uncorrelated suggesting complementary predictive ability
- Hence, we use Principal Component Analysis(PCA) to extract common factors on each of the two information sets separately

	PC1	PC2	PC3	PC4	PC5	PC6
Fundamental PCA factors						
Proportion of variance	25.82%	18.05%	12.97%	10.17%	6.69%	5.70%
Cumulative proportion	25.82%	43.87%	56.84%	67.01%	73.70%	79.40%
Technical PCA factors						
Proportion of variance	66.48%	8.90%	5.76%	3.84%	2.86%	2.64%
Cumulative proportion	66.48%	75.38%	81.14%	84.98%	87.84%	90.48%

Currency timing with Brandt and Santa-Clara [2006]

- We examine whether a risk-averse investor may profit from timing currency factors w.r.t. fundamental and technical predictors using the *parametric portfolio policy* of Brandt and Santa-Clara [2006]
- We estimate optimal portfolio weights based on predictive information rather than from predicted currency returns
- Assume a mean-variance investor whose optimal portfolio strategy is linear in the K predictors:

$$w_t = \theta z_t \tag{1}$$

where θ is an $N \times K$ matrix

- The optimization problem becomes (after quite some algebra)

$$\max_{\tilde{w}} E\left[\tilde{w}^{'}\tilde{r}_{t+1} - \frac{\gamma}{2}\tilde{w}^{'}\tilde{r}_{t+1}\tilde{r}_{t+1}^{'}\tilde{w}\right] \tag{2}$$

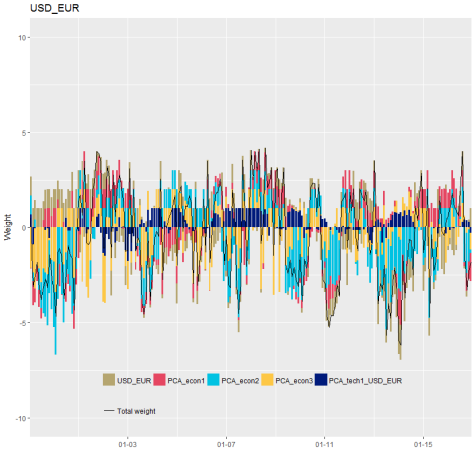
where $\tilde{w} = \text{vec}(\theta)^{'}$ and $\tilde{r}_{t+1} = z_t \otimes r_{t+1}$

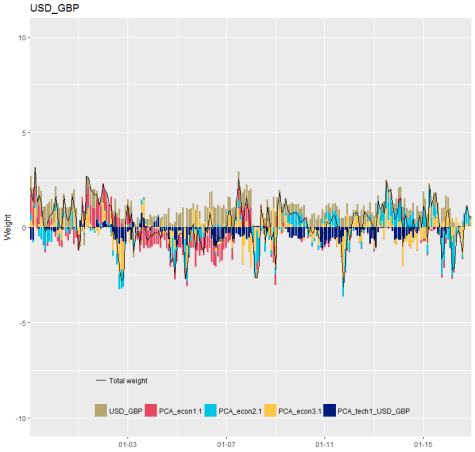
Illustrating the augmented asset space

$$\tilde{r}_t = \begin{bmatrix} r_{t_1}^{USD/EUR} & r_{t_1}^{USD/GBP} & r_{t_1}^{USD/EUR} z_{t_0} & rt1^{USD/GBP} z_{t_0} \\ r_{t_2}^{USD/EUR} & r_{t_2}^{USD/GBP} & r_{t_2}^{USD/EUR} z_{t_1} & r_{t_2}^{USD/GBP} z_{t_1} \end{bmatrix}$$

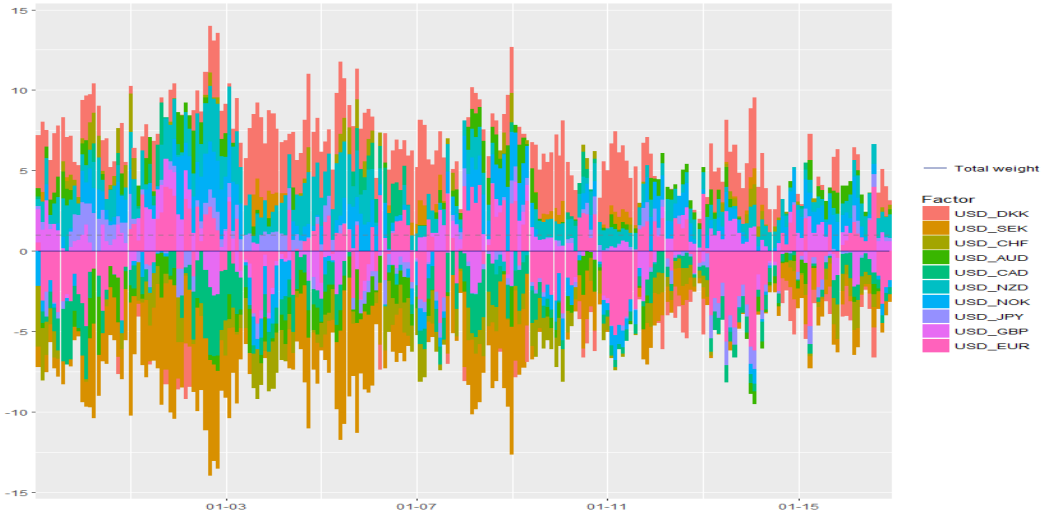
- Compute optimal portfolios over a 9-year expanding window

Optimal currency allocation weights: the case of USD/EUR & USD/GBP





Aggregate currency timings weights through time



Performance Evaluation

	Return p.a	Volatility p.a	Sharpe ratio	Information ratio	Max Draw-down
PPP currency portfolio	7.19	25.93	0.19	0.07	51.10
EW currency portfolio	3.16	8.46	0.11	0.07	24.39
MV currency portfolio	2.62	7.16	0.06	0.03	26.90

Optimal currency tilting

Exploiting cross-sectional currency characteristics

- Portfolio allocation based on style factors have been widely researched in stock markets
- For the FX market, we pick 3 FX Style variables that could proxy for currency expected returns, such as:
  1. Carry
     - Buy currencies with highest short-term interest rates and sell currencies with lowest short-term interest rates
  2. Value
     - Buy currencies with lowest 60-month change in the Real Exchange Rate (RER) and sell currencies with highest 60-month change in the RER
  3. Momentum
     - Buy 3-month winner currencies and sell 3-month loser currencies

Optimal Currency tilting with Brandt, Santa-Clara, and Valkanov [2009]

- Brandt, Santa-Clara, and Valkanov [2009] model asset weights as a linear function of asset characteristics:

$$w_{i,t} = f(x_{i,t}; \phi) = \overline{w_{i,t}} + \frac{1}{N_t} \phi^{'} \hat{x}_{i,t} \tag{3}$$

  with benchmark weight $\overline{w_{i,t}}$, standardized asset characteristics $\hat{x}_{i,t}$ and coefficient vector ϕ

- Coefficients are estimated through utility optimization:

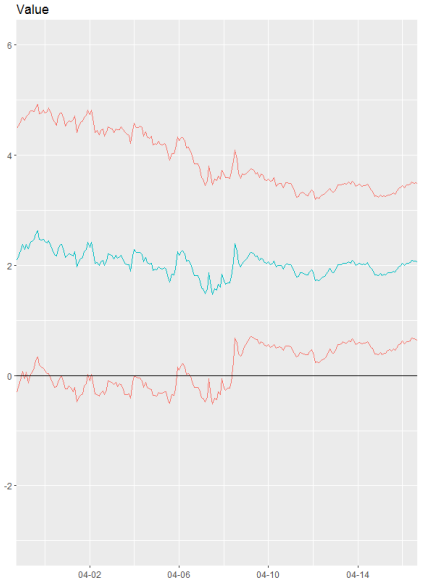
$$\max_{\{w_{i,t}\}_{i=1}^{N_t}} E_t \left[u(r_{p,t+1}) \right] = E_t \left[u \left(\sum_{i=1}^{N_t} w_{i,t} r_{i,t+1} \right) \right] \tag{4}$$

- For mean-variance utility, the optimization problem can be rewritten as:

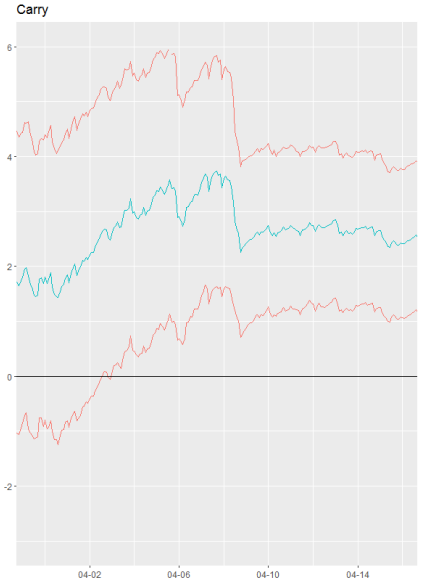
$$\max_{w_{i,t}} E \left[w_{i,t}^{'} r_{t+1} - \frac{\gamma}{2} (w_{i,t}^{'} r_{t+1})^2 \right] \tag{5}$$

- In this benchmark-relative management, deviations result only from differences in characteristics

ϕ coefficients



ϕ coefficients



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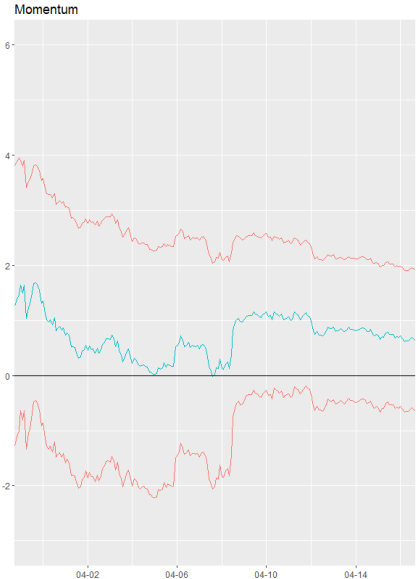
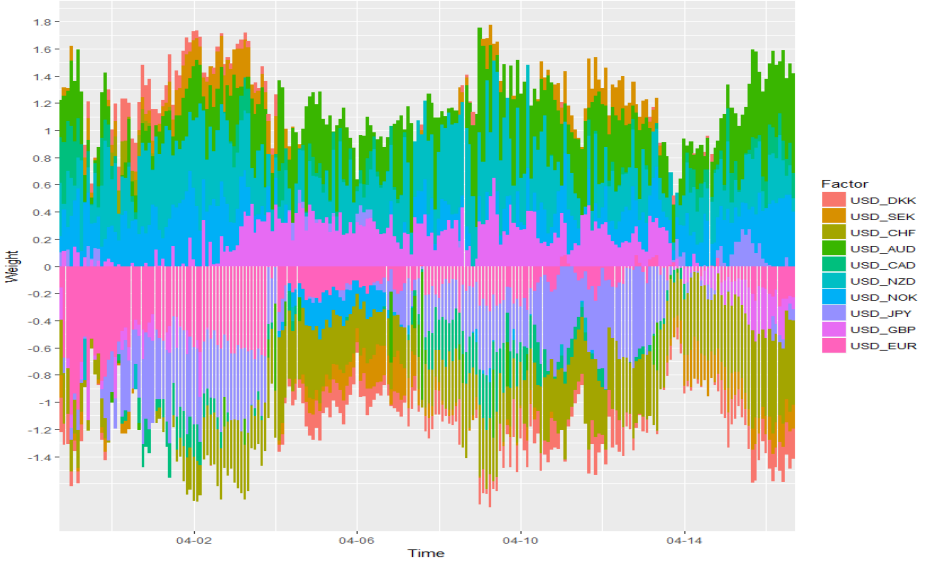


Optimal currency weights decomposition



Parametric Portfolio Policy vs Naive FX investment styles: Results

	$\hat{\phi}$	S.E	Return p.a	Vola p.a	Sharpe ratio	Information ratio	Max Draw-down
Panel A: Univariate models							
Momentum	0.45	0.64	2.11	2.97	-0.03	-0.05	5.50
Value	1.80*	0.75	4.30	5.45	0.39	0.37	8.98
Carry	2.42***	0.71	8.16	8.87	0.67	0.66	27.71
Panel B: Multivariate model							
Optimal Portfolio			8.96	8.83	0.77	0.76	20.67
Momentum	0.64	0.65					
Value	2.06*	0.72					
Carry	2.53***	0.69					
Panel C: Naïve models							
Mom Naïve			2.68	3.37	0.14	0.13	7.00
Val Naïve			6.19	7.05	0.57	0.55	11.51
Carry Naïve			7.68	11.16	0.49	0.45	37.86
Naïve Portolio (1/N)			8.70	9.40	0.69	0.68	27.77

Conclusion and Outlook

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- From our results, it is evident that optimal currency timing can be implemented using carefully chosen fundamental variables and technical indicator variables, yet we observe only moderate performance
- But currency tilting works along FX style factors
- Hence, these forecast-free options can be effectively adopted to overcome some drawbacks of models requiring forecasted expected return

Outlook

- Models based on mean-variance hence will profit from considering constraints, shrinkage(Black Litterman) or transaction penalties
- Extension to EM currencies(which would include then 20+ currencies)
- Integrate timing and tilting currencies in terns if an integrated factor timing strategy to identify when carry trades work

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