Appendix to 'Common Risk Factors in Currency Markets'

This Appendix reports additional robustness checks. We first consider different samples of currency returns. We then report principal component analysis of our currency portfolios. Finally, we report additional results on currency excess return predictability.

Appendix A Other Samples

We perform four robustness checks. First, we consider the sample proposed by Burnside et al. (2008). Following the methodology of Lustig and Verdelhan (2007), Burnside et al. (2008) build 5 currency portfolios. Burnside et al. (2008) claim that these currency excess returns are not related to any risk factor. Using the same methodology as in the main text, we find that these currency excess returns are clearly explained by two risk factors. Second, we consider different home countries. We take the perspective of the Swiss, UK and Japanese investors, and for each investor, we build currency portfolios, test their business cycle properties and we estimate the corresponding market prices of risk. Third, we divide our main sample into two sub-samples, starting either in 1983 or in 1995. Fourth, we consider the longer sample of currency excess returns built using Treasury bills in Lustig and Verdelhan (2007).

Appendix A1 Burnside et alii (2006, 2008)

Countries Our main dataset (used in the main text) comprises 37 forward and spot rates in US dollars collected from Reuters and Barclays and available on Datastream.[22] Our dataset of developed countries (also used in the main text) comprises 15 countries. Burnside et al. (2006) consider a smaller set of (at most) 10 developed countries: Belgium, Canada, Euro area, France, Germany, Italy, Japan, Netherlands, Switzerland, the United Kingdom and the United States.[23] Note that this sample is too restrictive because it does not even encompass forward (or equivalent futures) contracts traded on large institutionalized currency markets as the Chicago Mercantile Exchange. Burnside et al. (2006) conclude that there are no large exploitable excess returns that result from the failure of UIP because the difference between the forward discount and the rate of depreciation is absorbed largely by bid-ask spreads. In a revised version of the previous paper, Burnside et al. (2008) consider a sample of 21 developed countries: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, the UK, the U.S. and the Euro. They find large currency excess returns and note that, 'while transaction costs are quantitatively important, they do not explain the profitability of the carry trade' (page 9). As a result, they abstract from transaction costs and work

[22] In comparison to Burnside et al. (2007a) who use interest rates instead of forward contracts, we exclude Brazil, Bulgaria, Chile, Colombia, Croatia, Cyprus, Egypt, Estonia, Iceland, Israel, Kazakhstan, Kenya, Kuwait, Latvia, Lithuania, Malta, Morocco, Pakistan, Qatar, Romania, Russia, Slovakia, Slovenia, Tunisia, Turkey, United Arab Emirates, and Ukraine because neither Reuters nor Barclays report forward rates for these countries. Note that to use interest rates from these additional countries, one needs to check the financial openness of each country and correct for default events (see Lustig and Verdelhan (2007) for details).

[23] In comparison to the 10 countries in Burnside et al. (2006), we include Australia, Denmark, New Zealand, Norway, and Sweden in our sample of 15 developed countries.

with spot and forward rates that are the average of bid and ask rates. Burnside et al. (2008) build 5 portfolios of currency excess returns following the methodology of Lustig and Verdelhan (2007). They conclude that risk factors do not explain the excess returns of these 5 portfolios. In this appendix, we build the same 5 portfolios and show that we obtain the same conclusion as with our two other samples: two simple risk factors reproduce the cross-section of excess returns, implying that these excess returns are compensations for risk.

Burnside et al. (2008) use spot and forward rates denominated in UK pounds, collected by Barclays and available on Datastream. We follow their assumption and convert these series into dollars using midquotes. The sample starts in 02/1976 and ends in 1/2008 as in Burnside et al. (2008). Table 14 below reports summary statistics on these 5 currency portfolios. The carry trade strategy that goes short the currencies in the first portfolio and long the currencies in the last portfolio offers an average log excess return of 6.47 percent per year and an average Sharpe ratio of 0.9.[24] These values are certainly upper bounds on carry trade excess returns since they do not take into account any transaction costs.

Cross-section of currency excess returns This cross-section of excess returns reflects different exposures to risk factors. In order to show this point, we build again two risk factors: HML_{FX} corresponds to the return on the fifth portfolio minus the return on the first portfolio, and RX is the average return across the test assets. Table 15 reports asset pricing results. The loadings on HML_{FX} explain the cross-section of currency excess returns. The betas are highly significant. The first portfolio has a negative beta, and the last portfolio a positive one. The loadings on the average market return do not vary much across portfolios. The alphas are not significantly different from zero. The market price of risk is highly significant; it is somehow higher than our own estimates because these excess returns do not take into account bid-ask spreads.

Figure 7 plots realized average excess returns on the vertical axis against predicted average excess returns on the horizontal axis. In order to draw this figure, we do not even estimate the market price of risk. We regress each actual excess return on a constant and the risk factors RX and HML_{FX} to obtain the slope coefficient β^j. Each predicted excess returns is then obtained using the OLS estimate of β^j times the sample mean of the factors. It is obvious that these currency excess returns are risk premia.

Appendix A2 Foreign Investors

We now adopt the perspective of foreign investors and we consider currency excess returns denominated in foreign currency. We report summary statistics on these excess returns, test their business cycle properties and we estimate the market prices of risk.

Summary Statistics We consider the case of a UK investor, a Japanese investor and a Swiss investor. These are three countries with large and well-developed currency markets. We compute the excess returns that local investors would obtain if they had access to forward contracts in their own currency. We obtained these excess returns by converting dollars into local currency at the midpoint rate. This way, investors are not hit twice by the bid-ask spread. Summary statistics on these currency excess returns are reported in Table 16.

Business Cycle Properties Using employment data in each country, we show that foreign currency excess returns are predictable from the UK, Japan and Swiss perspectives. Table 17 reports these predictability results.

[24]Burnside et al. (2008) report monthly excess returns (see their table 3 page 29). For example, their last portfolio offers a monthly excess return of 0.0082 for a standard deviation of 0.028. Annualized, these values imply a Sharpe ratio of 1.01.

Cross-sectional Asset Pricing We now check the Euler equation of foreign investors in the UK, Japan and Switzerland. We construct the new asset pricing factors (HML_{FX} and RX_{FX}) in local currency and we use the local currency returns on our currency portfolios as test assets.

Table 8 in the main text reports market prices of risk and cross-sectional measures of fit. Table 18 in this appendix reports results of time series regressions of portfolio excess returns on the two factors, for each country.

Appendix A3 Time Sub-Samples

We also check the robustness of our results by dividing our main sample over the 1983-2008 period in two sub-samples, spanning the 1983-1994 and 1995-2008 periods. We run this test for both samples of developed, and developed and emerging countries. For each time sub-sample, we redo all the cross-sectional asset pricing tests. To save space, we do not report the corresponding tables here. We find that the HML_{FX} betas are very similar in both time sub-samples. In both cases, they range from -0.4 to 0.6 on developed and emerging countries and from around -0.5 to 0.5 on developed countries. The market prices of risk differ across time periods; it is higher and more precisely estimated in the 1995-2008 period. The cross-sectional fit is also higher in the second period. Because forward contracts were available only for a limited set of currencies, the first sub-sample uses, for example, at most 18 developed and emerging countries. The low number of countries and short sample clearly decreases the estimation power.

Appendix A4 Longer Sample of Treasury Bill-based Portfolios

Lustig and Verdelhan (2007) built eight portfolios of foreign T-bills sorted on interest rates, from a panel of 81 currencies. The data are annual, and the sample spans 1953-2002. We check whether the currency risk factors can explain the cross-sectional variation in excess returns on these foreign T-bills. HML_{FX} is defined as the spread between the seventh and the first portfolio. Table 19 reports the results. The estimated risk price for HML_{FX} varies between 4.10 percent on the whole sample and 6.20 percent on the post-Bretton-Woods subsample. This is very close to the estimate of 6.19 percent that we obtained on the basket of forward contracts. Also, these estimates are close to their respective sample means of 5.32 and 6.92 percentage points per annum. We also test whether the null that the α's are zero can be rejected. The results for both samples are reported in Table 20. The null cannot be rejected. Table 20 reports also all the portfolios βs on the two risk factors.

Using the HML_{FX} we constructed from the longer time series, we can explore the business cycle properties of HML_{FX}. We run a time series regression of HML_{FX} on US non-durable consumption growth and on durable consumption growth. Over the 1953-2002 sample, the consumption β of HML_{FX} is one; in the post-Bretton-Woods sample, it increases to 1.50. These estimates are statistically significant at the 5 percent level. The currency risk factor HML_{FX} is strongly pro-cyclical.

Appendix B Principal Component Analysis

Table 22 reports the principal component coefficients and variances of our currency portfolios.

Appendix C Additional Predictability Tests

Table 4 also checks whether IP growth predicts future currency returns in our smaller sample of developed countries. The slope coefficients in the projection of 12-month future returns on industrial production growth are larger than those we found on the entire sample of currencies; the coefficient varies between 127 and 174 basis points, when we control for the individual portfolio discount, and between 109 and 212 basis points when we control for the average forward discount. There is evidence that industrial production growth drives out the forward discount as a predictor.

The strong response of currency excess returns to industrial production resembles results reported by Cooper and Priestley (2007) on stock market excess returns. Cooper and Priestley (2007) show that the output gap, defined using the deviation of industrial production from a trend, is a very robust predictor of excess returns on the stock market in all G-7 countries. This variable is highly correlated with the growth rate of industrial production in our sample.

Table 23 reports the slope coefficient estimates for the 1-month, 3-month, 6-month and 12-month returns. In this case, inference about the slope coefficients is complicated by overlapping observations and autocorrelated returns. Hansen and Hodrick (1980) (HH) is the standard procedure to deal with overlapping observations. We use n lags to compute the HH variance-covariance matrix when dealing with n-month returns. We also report the Newey and West (1987) (NW) standard errors computed with the optimal number of lags; we allow for a maximum of $n+6$ lags. The NW and HH standard errors are very close at all the horizons we consider. The null that the slope coefficients are zero can be rejected at the 1% significance level in all cases.

To deal with the overlap problem, we simply dropped the overlapping observations by selecting only the first month in each period; we report the NW standard errors for this shorter sample. These standard errors are only slightly larger than those obtained on the whole sample; deleting these observations from the sample does not alter the inference. In addition, to guard against the poor performance of these tests statistics in small samples, we report bootstrapped standard errors. We bootstrap 10.000 samples from the residuals of an n-lag VAR that includes the returns and the forward discount. These small sample standard errors are 40 to 50 % larger at 3 to 12 month horizons. As a result, the null that the slope coefficients of the individual portfolio forward discounts are zero can no longer be rejected at the 5 % significance level for 3, 6 and 12 month returns. However, the null that the average forward discount does not predict excess returns can still be rejected at the 5% significance level. The p-values on the slope coefficients are invariably lower for the average discount than those for the individual portfolio forward discount regressions.

Appendix C1 Counter-cyclicality

Table 10 reports the correlation of the currency risk factor (the average forward discount) with the business cycle variables. Macro variables themselves help to forecast excess returns. In fact, the change in industrial production (IP) explains up to 37 percent of the variation in excess returns at the 12-month horizon. Table 24 reports regression results for :

$$rx^{j,k}_{net,t+k} = \gamma_0 + \gamma_{IP}\Delta \log IP_t + \eta^j_t.$$

At the 12-month horizon, all the estimated slope coefficients are significantly negative. A one percentage point drop in the annual change in industrial production raises the dollar risk premium by 150 to 200 basis points per annum. At shorter horizons, this number is in the 100 to 150 basis point range. Except for the 1-month horizon forecasts, the Wald test for the slope coefficient has p-values that are smaller than 5 percent for all portfolios.

Appendix C2 Spreads

Table 25 lists the correlations with our macro and financial variables.

We report the predictability results in Table 26. We consider the volatility index and the credit default spread. In the top panel we consider the returns on the sixth minus the first portfolio. In the bottom panel, we consider the returns on the second minus the first portfolio. To construct these, we sort all the currencies into two portfolios. The left panel reports the results for one-month ahead forecasts. The right panel reports the results for 12-month ahead forecasts. These variables have some forecasting power for the HML_{FX} returns.

Appendix D Model Calibration

Additional Constraints When we look for the moments, we impose some addition constraints. The parameter γ, δ and σ have to be positive, ϕ has to be between 0 and 1. The processes z and z^w follow Gamma distributions. The Feller parameters $F = 2(1-\phi)\theta/\sigma^2$ and $F^w = 2(1-\phi^w)\theta^w/(\sigma^w)^2$ govern the moments of these distributions. To ensure that these processes remain positive, the Feller parameters need to be above unity. The skewness of each process is is also pinned down by the Feller coefficients ($2/\sqrt{F}$ and $2/\sqrt{F^w}$). In our data, the average skewness of nominal interest rates is 0.6. As a result, we impose both Feller parameters to be above 15. This is only an approximation of the real interest rates' skewness because real interest rates depend on the two risk processes z and z^w.

Table 14: US Investor - Portfolios of Countries in Burnside et alii (2008)

Portfolio	1	2	3	4	5
			Spot change: Δs^j		
Mean	-1.47	-1.19	-0.16	-0.34	2.23
Std	10.07	10.02	9.00	8.88	9.90
			Discount: $f^j - s^j$		
Mean	-3.23	-0.78	0.79	2.44	6.94
Std	0.78	0.72	0.72	0.85	1.56
			Excess Return: rx^j (without bid-ask)		
Mean	-1.77	0.41	0.96	2.77	4.71
SR	-0.17	0.04	0.11	0.31	0.48
			Long-Short: $rx^j - rx^1$ (without bid-ask)		
Mean		2.17	2.72	4.54	6.47
SR		0.44	0.47	0.71	0.90

Notes: This table reports summary statistics for currencies sorted into portfolios. We report the moments in dollars for average changes in log of the spot exchange rate Δs^j in portfolio j, the average log forward discount $f^j - s^j$, the average log excess return rx^j without bid-ask spreads, and the average returns on the long short strategy $rx^j - rx^1$. Log currency excess returns are computed as $rx^j_{t+1} = -\Delta s^j_{t+1} + f^j_t - s^j_t$. All moments are annualized and reported in percentage points. For excess returns, the table also reports Sharpe ratios, computed as ratios of annualized means to annualized standard deviations. Averages and standard deviations are reported in percentage points. The portfolios are constructed by sorting currencies into five groups at time t based on the one-month forward discount at the end of period $t-1$. Portfolio 1 contains currencies with the lowest interest rates. Portfolio 5 contains currencies with the highest interest rates. Data are monthly, from Barclays (Datastream). The sample period is 02/1976 - 01/2008.

Table 15: Asset Pricing - Portfolios of Countries in Burnside et alii (2008)

Panel I: Factor Prices and Loadings							
	$\lambda_{HML_{FX}}$	λ_{RX}	$b_{HML_{FX}}$	b_{RX}	R^2	$RMSE$	χ^2
GMM_1	6.60	3.39	1.04	0.33	95.70	0.38	
	[2.06]	[2.15]	[0.33]	[0.22]			74.53
GMM_2	6.29	3.42	0.99	0.33	95.36	0.39	
	[2.04]	[2.13]	[0.33]	[0.22]			75.08
FMB	6.60	3.39	1.04	0.33	93.56	0.38	
	[1.49]	[1.83]	[0.24]	[0.19]			64.74
	(1.49)	(1.83)	(0.24)	(0.19)			67.51
$Mean$	**6.38**	**3.41**					
Panel II: Factor Betas							
$Portfolio$	$\alpha_0^j(\%)$	$\beta^j_{HML_{FX}}$	β^j_{RX}	$R^2(\%)$	$\chi^2(\alpha)$	$p-value$	
1	-0.22	-0.50	1.01	95.41			
	[0.48]	[0.02]	[0.02]				
2	-0.45	-0.11	1.10	92.83			
	[0.68]	[0.03]	[0.02]				
3	0.31	-0.01	0.97	91.22			
	[0.59]	[0.03]	[0.02]				
4	0.59	0.12	0.91	86.15			
	[0.75]	[0.03]	[0.02]				
5	-0.22	0.50	1.01	95.54			
	[0.48]	[0.02]	[0.02]				
All					1.24	0.94	

Notes: Panel I reports results from GMM and Fama-McBeth asset pricing procedures. Market prices of risk λ, the adjusted R^2, the square-root of mean-squared errors $RMSE$ and the p-values of χ^2 tests on pricing errors are reported in percentage points. b denotes the vector of factor loadings. Excess returns used as test assets and risk factors take into account bid-ask spreads. All excess returns are multiplied by 12 (annualized). The standard errors in brackets are Newey and West (1987) standard errors computed with the optimal number of lags according to Andrews (1991). Shanken (1992)-corrected standard errors are reported in parentheses. We do not include a constant in the second step of the FMB procedure. Panel II reports OLS estimates of the factor betas. R^2s and p-values are reported in percentage points. The χ^2 test statistic $\alpha' V_\alpha^{-1}\alpha$ tests the null that all intercepts are jointly zero. This statistic is constructed from the Newey-West variance-covariance matrix (1 lag) for the system of equations (see Cochrane (2001), p. 234). Data are monthly, from Datastream. The sample of currencies corresponds to the one used in Burnside et alii (2008). The sample period is 2/1976 - 01/2008.

Table 16: Summary Statistics - Foreign Investors - Portfolios of Developed and Emerging Countries - Midpoint Conversion

Portfolio	1	2	3	4	5	6
			Panel I: UK			
			Excess Return: rx^j_{net}			
Mean	−5.21	−4.26	−3.88	−1.50	−1.16	−0.24
SR	−0.61	−0.52	−0.46	−0.18	−0.14	−0.03
			Long-Short: $rx^j_{net} - rx^1_{net}$			
Mean		0.94	1.33	3.70	4.04	4.96
SR		0.18	0.23	0.56	0.61	0.55
			Panel II: Japan			
			Excess Return: rx^j_{net}			
Mean	−1.31	−2.12	−0.63	1.71	2.24	2.80
SR	−0.14	−0.21	−0.06	0.16	0.23	0.24
			Long-Short: $rx^j_{net} - rx^1_{net}$			
Mean		−0.81	0.68	3.03	3.55	4.11
SR		−0.15	0.12	0.50	0.55	0.47
			Panel III: Switzerland			
			Excess Return: rx^j_{net}			
Mean	−3.02	−1.17	−1.09	0.58	1.56	2.23
SR	−0.40	−0.15	−0.12	0.07	0.20	0.22
			Long-Short: $rx^j_{net} - rx^1_{net}$			
Mean		1.85	1.93	3.59	4.57	5.25
SR		0.33	0.32	0.55	0.72	0.60

Notes: This table reports summary statistics for currencies sorted into portfolios. We report averages and Sharpe ratios of log excess returns rx^j_{net} with bid-ask spreads and log excess returns on the long short strategy $rx^j_{net} - rx^1_{net}$ in *UK pounds*, in *Japanese yen*, and in *Swiss francs*. All moments are annualized and reported in percentage points. The portfolios are constructed by sorting currencies into six groups at time t based on the one-month forward discount (i.e nominal interest rate differential) at the end of period $t-1$. Portfolio 1 contains currencies with the lowest interest rates. Portfolio 6 contains currencies with the highest interest rates. Data are monthly, from Barclays and Reuters (Datastream). The sample period is 11/1983 - 03/2008.

Table 17: Forecasting Excess Returns with *EM*

Months	γ_{EM}	$p(\%)$	R^2	γ_{EM}	$p(\%)$	R^2	γ_{EM}	$p(\%)$	R^2
		US			**UK**			**Japan**	
1	−1.88	5.15	6.09	−2.88	0.10	17.93	−0.30	90.58	0.37
	[1.08]			[0.92]			[0.75]		
2	−0.81	23.21	1.85	−1.91	4.46	9.21	−0.73	42.75	1.64
	[0.79]			[1.06]			[1.01]		
3	−1.67	2.96	6.87	−1.33	5.44	5.36	−1.15	11.12	4.68
	[0.85]			[0.78]			[0.83]		
4	−1.72	3.82	8.09	−0.87	24.73	2.16	−1.51	4.26	7.62
	[0.92]			[0.88]			[0.83]		
5	−2.49	0.94	12.29	−1.40	3.38	4.74	−1.52	4.44	7.83
	[1.04]			[0.73]			[0.85]		
6	−2.12	2.11	7.17	−0.83	22.19	1.39	−2.13	1.20	11.46
	[1.01]			[0.80]			[0.92]		

Notes: This table reports the forecasted excess returns using the 12-month change in the level of employment for the US, UK and Japan. The standard errors in brackets are Newey-West standard errors computed with the optimal number of lags. The p-values (reported in percentage points) are for a Wald-test: $\gamma_{EM} = 0$. All the returns annualized and reported in percentage points. Data are monthly, from Datastream and Global Financial Data. The sample period is 11/1983 - 04/2007.

Table 18: Factor Betas - Foreign Investors

$Portfolio$	α_0^i	$\beta^i_{HML_{FX}}$	β^i_{RX}	R^2	$\chi^2(\alpha)$	$p-value$
			Panel I: UK			
1	−0.48	−0.39	0.98	91.40		
	[0.56]	[0.02]	[0.03]			
2	−0.90	−0.15	1.00	81.97		
	[0.84]	[0.03]	[0.04]			
3	−0.78	−0.08	1.02	79.06		
	[0.85]	[0.03]	[0.04]			
4	1.57	−0.08	0.99	73.07		
	[0.91]	[0.04]	[0.04]			
5	1.06	0.09	1.02	77.77		
	[0.79]	[0.04]	[0.04]			
6	−0.48	0.61	0.98	92.14		
	[0.56]	[0.02]	[0.03]			
					7.30	0.29
			Panel II: Japan			
1	−0.11	−0.37	0.96	93.83		
	[0.47]	[0.02]	[0.02]			
2	−1.94	−0.17	1.05	86.61		
	[0.79]	[0.03]	[0.03]			
3	−0.67	−0.11	1.02	86.47		
	[0.71]	[0.03]	[0.03]			
4	1.53	−0.07	1.05	84.58		
	[0.88]	[0.04]	[0.05]			
5	1.31	0.09	0.96	84.47		
	[0.84]	[0.04]	[0.03]			
6	−0.11	0.63	0.96	96.05		
	[0.47]	[0.02]	[0.02]			
					14.28	0.03
			Panel III: Switzerland			
1	−0.75	−0.38	0.99	89.05		
	[0.53]	[0.02]	[0.02]			
2	−0.44	−0.13	1.00	77.39		
	[0.95]	[0.04]	[0.05]			
3	−0.31	−0.12	1.09	79.23		
	[0.82]	[0.03]	[0.04]			
4	1.10	−0.07	1.00	72.33		
	[0.97]	[0.04]	[0.05]			
5	1.15	0.08	0.94	76.23		
	[0.84]	[0.04]	[0.05]			
6	−0.75	0.62	0.99	93.76		
	[0.53]	[0.02]	[0.02]			
					4.48	0.61

Notes: This table reports results OLS estimates of the factor betas. The intercept α_0 β, and the R^2 are reported in percentage points. The standard errors in brackets are Newey-West standard errors computed with the optimal number of lags. The χ^2 test statistic $\alpha' V_\alpha^{-1} \alpha$ tests the null that all intercepts are jointly zero. This statistic is constructed from the Newey-West variance-covariance matrix (1 lag) for the system of equations (Cochrane (2001), p. 234). The portfolios are constructed by sorting currencies into six groups at time t based on the the currency excess return at the end of period $t-1$. Portfolio 1 contains currencies with the lowest previous excess return. Portfolio 5 contains currencies with the highest previous excess return. Data are monthly, from Barclays. The sample period is 11/1983 - 03/2008. Excess returns used as test assets take into account bid-ask spreads. All excess returns are multiplied by 12.

Table 19: Asset Pricing - T-Bill portfolios

	$\lambda_{HML_{FX}}$	λ_{RX}	$b_{HML_{FX}}$	b_{RX}	R^2	$RMSE$	χ^2
				1953-2002			
GMM_1	4.10	0.25	8.39	-2.05	42.47	1.11	
	[1.25]	[1.10]	[2.76]	[3.60]			44.44
GMM_2	3.89	0.18	8.00	-2.13	42.09	1.11	
	[0.81]	[0.91]	[1.95]	[3.05]			45.47
FMB	4.10	0.25	8.22	-2.01	42.47	1.11	
	[1.17]	[0.84]	[2.34]	[2.54]			10.18
	(1.21)	(0.84)	(2.43)	(2.56)			24.16
$Mean$	**5.32**	0.128					
				1971-2002			
GMM_1	6.20	0.31	9.25	-2.48	72.50	0.92	
	[2.07]	[1.93]	[3.29]	[4.17]			78.19
GMM_2	5.80	0.30	8.65	-2.29	72.13	0.92	
	[1.09]	[1.18]	[1.96]	[2.73]			80.26
FMB	6.20	0.31	8.96	-2.41	72.50	0.92	
	[1.66]	[1.30]	[2.37]	[2.55]			68.36
	(1.73)	(1.30)	(2.49)	(2.57)			86.28
$Mean$	**6.92**	0.255					

Notes: This table reports results from GMM and Fama-McBeth asset pricing procedures. Market prices of risk λ, the adjusted R^2, the square-root of mean-squared errors $RMSE$ and the p-values of χ^2 tests are reported in percentage points. b_1 represents the factor loading. The portfolios are constructed by sorting currencies into six groups at time t based on the interest rate differential at the end of period $t-1$. Portfolio 1 contains currencies with the lowest interest rates. Portfolio 8 contains currencies with the highest interest rates. Data are annual, from Global Financial Data. Standard errors are reported in brackets. Shanken-corrected standard errors are reported in parentheses. We do not include a constant in the second step of the FMB procedure.

Table 20: Factor Betas - US Investor

$Portfolio$	α_0^j	$\beta_{HML_{FX}}^j$	β_{RX}^j	R^2	α_0^j	$\beta_{HML_{FX}}^j$	β_{RX}^j	R^2
	1971-2002				**1953-2002**			
1	-0.02	-0.46	0.97	80.91	0.02	-0.47	0.95	79.28
	[0.71]	[0.06]	[0.10]		[0.44]	[0.06]	[0.09]	
2	0.07	-0.03	0.62	41.16	-1.16	0.04	0.64	32.92
	[0.92]	[0.07]	[0.16]		[0.96]	[0.10]	[0.18]	
3	-0.77	-0.04	0.99	74.28	-0.58	-0.05	0.97	72.11
	[0.86]	[0.09]	[0.12]		[0.52]	[0.08]	[0.12]	
4	0.40	0.06	1.20	78.00	-0.33	0.09	1.19	73.25
	[1.02]	[0.10]	[0.13]		[0.75]	[0.09]	[0.13]	
5	-0.32	-0.09	0.98	56.83	0.38	-0.12	0.98	55.44
	[1.15]	[0.11]	[0.12]		[0.72]	[0.11]	[0.12]	
6	-1.38	0.16	1.05	67.44	-1.12	0.15	1.05	64.26
	[1.21]	[0.10]	[0.14]		[0.78]	[0.09]	[0.14]	
7	-0.02	0.54	0.97	88.39	0.02	0.53	0.95	87.25
	[0.71]	[0.06]	[0.10]		[0.44]	[0.06]	[0.09]	
8	2.07	-0.13	1.22	34.31	2.76	-0.17	1.28	34.00
	[3.40]	[0.19]	[0.44]		[2.10]	[0.15]	[0.40]	
$\chi^2(\alpha)$	1.09			4.55				
$p-value$	99.06			80.33				

Notes: This table reports results OLS estimates of the factor betas. The intercept α_0 β, and the R^2 are reported in percentage points. The standard errors in brackets are Newey-West standard errors computed with the optimal number of lags. The χ^2 test statistic $\alpha' V_\alpha^{-1} \alpha$ tests the null that all intercepts are jointly zero. This statistic is constructed from the Newey-West variance-covariance matrix (1 lag) for the system of equations (Cochrane (2001), p. 234). The portfolios are constructed by sorting currencies into six groups at time t based on the interest rate differential at the end of period $t-1$. Portfolio 1 contains currencies with the lowest interest rates. Portfolio 6 contains currencies with the highest interest rates. Data are annual from Global Financial Data. Standard errors are reported in parenthesis. Shanken-corrected standard errors are reported in brackets.

Table 21: Consumption Betas for HML_{FX}

	$\beta_c^{HML_{FX}}$	$p(\%)$	R^2	$\beta_d^{HML_{FX}}$	$p(\%)$	R^2
	Panel I: Nondurables			*Panel II: Durables*		
$1953-2002$	1.00		4.04	1.06		9.07
	[0.44]	2.23		[0.40]	0.89	
$1971-2002$	1.54		8.72	1.65		14.02
	[0.52]	0.28		[0.60]	0.63	

Notes: Each entry of this table reports OLS estimates of β_1 in the following time-series regression of the spread on the factor: $HML_{FX,t+1} = \beta_0 + \beta_1 f_t + \epsilon_{t+1}$. $HML_{FX,t+1}$ is the return on the seventh minus the return on the first portfolio. The estimates are based on annual data. The standard errors are reported in brackets. We use Newey-West heteroskedasticity-consistent standard errors with an optimal number of lags to estimate the spectral density matrix following Andrews (1991). The p-values (reported in %) are for a t-test on the slope coefficient. The factor f_t is non-durable consumption growth (Δc) in the left panel and durable consumption growth (Δd) in the right panel. The sample is $1953-2002$ in the upper panel and $1971-2002$ in the lower panel.

Table 22: Principal Components

Portfolio	1	2	3	4	5	6	
1	0.43	0.41	−0.18	0.31	0.72	0.03	70.07
2	0.39	0.26	−0.14	−0.02	−0.44	0.75	12.25
3	0.39	0.26	−0.46	−0.38	−0.31	−0.57	6.18
4	0.38	0.05	0.72	−0.56	0.16	−0.01	4.51
5	0.42	−0.11	0.38	0.66	−0.37	−0.31	3.76
6	0.43	−0.82	−0.28	−0.10	0.18	0.11	3.23

Notes: This table reports the principal component coefficients of the currency portfolios. The last column reports (in %) the share of the total variance explained by each factor. Data are monthly, from Barclays and Reuters (Datastream). The sample period is 11/1983 - 03/2008.

Table 23: Forecasting Excess Returns with Forward Discounts

Portfolio	γ_F	R^2	$\gamma_{\mathbf{F}}$	R^2	γ_F	R^2	$\gamma_{\mathbf{F}}$	R^2
	one-month				3-months			
1	1.08	4.29	3.76	8.35	2.41	8.35	4.55	19.23
NW	[0.33]		[0.64]		[1.34]		[0.89]	
HH	[0.23]		[0.57]		[1.40]		[0.92]	
No overlap	[0.33]		[0.64]		[1.24]		[0.96]	
12 lag VAR	[0.36]		[0.73]		[1.35]		[1.17]	
6	0.72	2.65	3.12	4.59	0.96	4.03	3.52	8.82
NW	[0.21]		[0.84]		[0.44]		[1.17]	
HH	[0.21]		[0.85]		[0.44]		[1.23]	
No overlap	[0.21]		[0.84]		[0.48]		[1.15]	
12 lag VAR	[0.32]		[0.94]		[0.61]		[1.53]	
	six-months				one-year			
1	4.12	26.62	4.82	32.38	3.30	26.85	4.15	35.40
NW	[0.73]		[0.78]		[0.73]		[0.74]	
HH	[0.78]		[0.81]		[0.76]		[0.67]	
No overlap	[1.01]		[0.80]		[0.99]		[1.37]	
12 lag VAR	[1.21]		[1.14]		[1.17]		[0.98]	
6	1.07	6.40	3.41	13.68	1.30	11.50	3.18	19.10
NW	[0.47]		[1.14]		[0.46]		[1.11]	
HH	[0.50]		[1.21]		[0.49]		[1.22]	
No overlap	[0.55]		[1.05]		[0.69]		[1.26]	
12 lag VAR	[0.73]		[1.62]		[0.85]		[1.65]	

Notes: This table reports the n-month ahead forecasted excess returns using the n-month portfolio-specific forward discount and the average n-month forward discount. The Newey and West (1987) (NW) standard errors are computed with the optimal number of lags. The Hansen and Hodrick (1980) (HH) standard errors are computed with n lags for the n-month returns. The VAR uses n lags for the n-month returns. All the returns are annualized and reported in percentage points. Data are monthly from Datastream . The sample period is 11/1983 - 08/2007.

Table 24: Forecasting Excess Returns with IP

Portfolios	γ_{IP}	R^2	*Portfolios*	γ_{IP}	R^2	*Portfolios*	γ_{IP}	R^2
			Panel I: All Countries					
1	−1.68	23.06	2	−1.20	18.57	3	−1.55	27.80
NW	[0.42]			[0.37]			[0.33]	
HH	[0.44]			[0.38]			[0.36]	
12 lag VAR	[0.69]			[0.45]			[0.45]	
No overlap	[0.58]			[0.46]			[0.46]	
4	−1.50	29.20	5	−1.98	36.79	6	−1.66	19.22
NW	[0.31]			[0.33]			[0.44]	
HH	[0.33]			[0.33]			[0.47]	
12 lag VAR	[0.43]			[0.49]			[0.72]	
No overlap	[0.37]			[0.60]			[0.53]	
			Panel II: Developed Countries					
1	−1.84	20.96	2	−1.84	21.70	3	−1.98	30.34
NW	[0.47]			[0.46]			[0.32]	
HH	[0.50]			[0.49]			[0.34]	
12 lag VAR	[0.83]			[0.80]			[0.60]	
No overlap	[0.58]			[0.52]			[0.30]	
4	−1.86	31.45	5	−1.98	33.06			
NW	[0.31]			[0.32]				
HH	[0.32]			[0.34]				
12 lag VAR	[0.52]			[0.68]				
No overlap	[0.28]			[0.32]				

Notes: This table reports the forecasted excess returns using the 12-month change in US Industrial Production. All the returns annualized and reported in percentage points. Data are monthly, from Datastream and Global Financial Data. The sample period is 11/1983 - 04/2007. Panel I uses the entire sample of countries. Panel II focuses on developed countries.

Table 25: Forecasted HML_{FX} Return Correlations

Portfolio	IP	Pay	$Help$	$Spread$	$Slope$	Vol
2	−0.37	−0.24	−0.34	0.33	0.09	0.12
	[0.07]	[0.01]	[0.20]	[0.05]	[0.08]	[0.07]
3	−0.38	−0.22	−0.33	0.32	0.10	0.14
	[0.09]	[0.02]	[0.19]	[0.05]	[0.09]	[0.07]
4	−0.38	−0.20	−0.32	0.31	0.10	0.17
	[0.11]	[0.03]	[0.19]	[0.05]	[0.10]	[0.08]
5	−0.36	−0.16	−0.30	0.31	0.09	0.19
	[0.14]	[0.03]	[0.19]	[0.05]	[0.12]	[0.09]
6	−0.23	−0.09	−0.19	0.28	0.08	0.25
	[0.28]	[0.08]	[0.20]	[0.06]	[0.22]	[0.19]

Notes: This table reports the contemporaneous correlation $Corr\left[\widehat{E}_t[rx^j_{t+1} - rx^1_{t+1}], x_t\right]$ of forecasted excess returns with different variables x_t: the 12-month percentage change in industrial production ($\Delta \log IP_t$), in the total US non-farm payroll ($\Delta \log Pay_t$), and of the Help-Wanted index ($\Delta \log Help_t$), the default spread ($Spread_t$), the slope of the yield curve ($Slope_t$) and the CBOE $S\&P$ 500 volatility index (Vol_t). Data are monthly, from Datastream and Global Financial Data. The sample period is 11/1983 - 08/2007.

Table 26: Predictability of Spread Returns

	Panel I: $rx^6 - rx^1$				Panel II: $rx^2 - rx^1$			
	1-month		12-month		1-month		12-month	
Portfolios	γ_x	R^2	γ_x	R^2	γ_x	R^2	γ_x	R^2
VIX	37.12	1.96	18.57	4.44	23.16	2.24	12.08	5.61
NW	[18.10]		[8.61]		[8.35]		[5.17]	
HH	[18.85]		[9.44]		[8.93]		[8.93]	
VAR	[24.00]		[13.99]		[11.79]		[9.48]	
No overlap	[18.10]		[3.04]		[8.35]		[3.24]	
Spread	6.64	1.97	3.48	4.23	3.56	1.65	2.66	8.08
NW	[2.65]		[1.70]		[1.43]		[0.84]	
HH	[2.68]		[1.73]		[1.46]		[1.46]	
VAR	[3.39]		[3.09]		[1.98]		[1.67]	
No overlap	[2.65]		[0.95]		[1.43]		[0.98]	

Notes: This table reports slope coefficients and R^2 of predictability regressions. In the left panel, we use the returns on the sixth minus the returns on the first portfolios. In the right panel, we rank all currencies in two portfolios and use the difference in returns between these two portfolios. In both panels, we consider returns at one-month and twelve-month horizons. All returns annualized and reported in percentage points. Data are monthly, from Datastream and Global Financial Data. The sample period is 11/1983 - 04/2007.

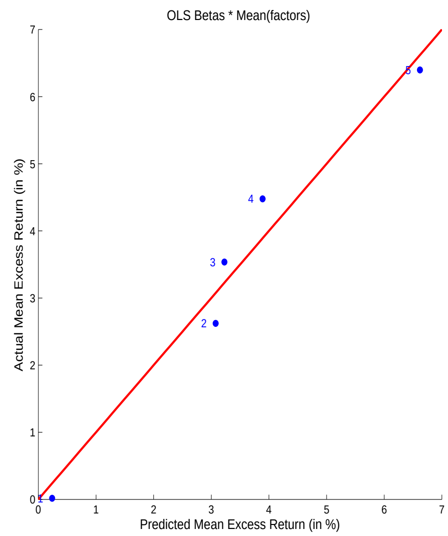

Figure 7: Predicted against Actual Excess Returns - Portfolios of Countries in Burnside et alii (2008).

This figure plots realized average excess returns on the vertical axis against predicted average excess returns on the horizontal axis. We regress each actual excess return on a constant and the risk factors RX and HML_{FX} to obtain the slope coefficient β^j. Each predicted excess returns is obtained using the OLS estimate of β^j times the sample mean of the factors. All returns are annualized. The data are monthly. The sample is 2/1976 - 01/2008.