

Internet Appendix for:
Volatility Risk Premia and Exchange Rate Predictability*
(not for publication)

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Table A1

Country-specific volatility risk premia

This table presents summary statistics for the one-year volatility risk premium (VRP_t) defined as the difference between the realized volatility (RV_t) and the synthetic volatility swap rate (SW_t). RV_t is calculated using daily exchange rate returns over the previous year. SW_t is computed as in Britten-Jones and Neuberger (2000) using one-year currency option implied volatilities. Q_j refers to the j th percentile. AC indicates the one-year autocorrelation coefficient. VRP_t , RV_t , and SW_t are expressed in percentage per annum. The sample period covers daily data from January 1998 to December 2013.

Currencies	<i>AUD</i>	<i>CAD</i>	<i>CHF</i>	<i>DKK</i>	<i>EUR</i>	<i>GBP</i>	<i>JPY</i>	<i>NOK</i>	<i>NZD</i>	<i>SEK</i>	<i>BRL</i>	<i>CZK</i>	<i>HUF</i>	<i>KRW</i>	<i>MXN</i>	<i>PLN</i>	<i>SGD</i>	<i>TRY</i>	<i>TWD</i>	<i>ZAR</i>	
<i>Panel A: Volatility risk premium (VRP)</i>																					
<i>Mean</i>	-0.04	-0.74	-0.42	-1.31	-1.34	-1.22	-0.91	-0.75	-0.35	-0.71	-2.70	-0.98	-2.15	-2.32	-3.34	-0.78	-1.81	-3.73	-2.50	-2.32	
<i>Sdev</i>	2.62	1.40	1.50	1.70	1.74	1.77	1.78	2.00	2.24	2.20	4.46	3.07	3.51	5.20	4.36	3.68	1.66	2.71	1.66	2.80	
<i>Skew</i>	1.22	-0.56	0.07	-0.76	-0.81	0.11	0.37	0.52	0.33	0.96	0.31	1.06	-0.25	-0.14	-2.38	-0.28	-1.29	0.70	-1.12	-0.05	
<i>Kurt</i>	8.13	4.96	3.33	4.68	4.54	6.14	3.47	5.13	4.99	7.01	5.01	5.00	3.81	7.42	11.76	5.19	5.40	4.08	4.89	4.43	
<i>Q₅</i>	-3.87	-3.11	-2.82	-4.44	-4.67	-3.73	-3.63	-4.06	-3.65	-3.89	-9.56	-5.55	-8.64	-9.22	-11.83	-7.03	-4.76	-7.56	-5.15	-6.63	
<i>Q₉₅</i>	3.84	1.33	2.15	0.62	0.61	1.01	1.30	2.06	4.20	3.34	7.18	6.37	3.45	8.85	0.40	5.50	0.22	2.13	-0.32	2.09	
<i>AC</i>	0.01	0.20	-0.25	-0.05	-0.02	0.00	0.19	-0.07	0.03	-0.30	0.00	-0.27	-0.34	-0.10	-0.09	-0.25	-0.11	-0.12	0.22	-0.09	
<i>Panel B: Realized volatility (RV)</i>																					
<i>Mean</i>	12.61	8.37	11.03	10.04	10.02	8.82	11.00	11.85	13.39	11.91	14.83	13.25	17.40	11.35	10.90	16.60	5.66	13.18	4.05	17.20	
<i>Sdev</i>	4.38	3.21	2.19	2.12	2.11	2.72	2.75	3.27	3.53	3.65	5.63	4.59	5.24	7.54	4.57	5.91	1.72	4.63	1.02	4.31	
<i>Skew</i>	2.20	1.26	0.81	0.79	0.79	2.34	1.28	1.96	1.73	2.10	1.60	0.87	0.32	1.65	0.86	0.63	0.57	0.90	0.27	1.28	
<i>Kurt</i>	8.01	4.37	3.75	4.72	4.74	8.29	4.03	6.96	6.29	7.29	4.68	3.23	2.33	4.54	3.11	2.59	2.03	3.17	2.24	3.95	
<i>Q₅</i>	8.55	4.78	7.56	6.52	6.46	6.50	7.88	8.37	9.77	8.49	8.58	7.02	9.94	4.69	5.26	9.03	3.42	6.78	2.50	12.58	
<i>Q₉₅</i>	25.34	16.39	15.81	14.92	14.83	16.66	17.63	20.74	22.13	21.44	29.05	23.82	27.91	30.59	21.57	29.19	8.61	23.48	5.79	27.92	
<i>AC</i>	0.26	0.59	-0.09	0.16	0.10	0.26	0.37	0.32	0.30	0.26	-0.04	0.08	-0.08	0.06	-0.05	0.17	-0.03	0.12	0.06	-0.07	
<i>Panel C: Synthetic volatility swap rate (SW)</i>																					
<i>Mean</i>	12.65	9.11	11.45	11.35	11.36	10.04	11.92	12.59	13.74	12.62	17.53	14.23	19.54	13.67	14.24	17.38	7.47	16.91	6.55	19.52	
<i>Sdev</i>	3.70	3.28	2.11	2.67	2.68	2.77	2.76	3.07	3.49	3.09	5.14	4.46	5.74	8.01	6.50	6.38	2.54	3.81	2.09	3.84	
<i>Skew</i>	1.39	1.42	0.47	0.78	0.77	1.84	0.54	1.23	1.25	1.26	1.92	0.59	0.57	1.63	1.64	0.70	0.70	0.25	1.34	1.54	
<i>Kurt</i>	5.01	4.77	3.90	3.82	3.77	6.69	2.84	4.22	4.30	4.17	8.32	3.55	2.80	6.96	7.03	3.30	3.25	3.69	4.89	5.70	
<i>Q₅</i>	8.22	5.87	7.69	7.18	7.17	7.38	8.07	8.88	9.81	8.94	11.57	7.09	11.44	4.60	7.26	8.46	3.81	9.88	4.17	14.96	
<i>Q₉₅</i>	19.99	15.96	15.50	16.06	16.30	15.61	16.87	18.66	21.01	18.73	28.37	22.66	30.75	29.84	28.03	29.76	12.72	23.68	10.56	27.74	
<i>AC</i>	0.48	0.66	0.23	0.34	0.34	0.48	0.61	0.48	0.51	0.48	0.08	0.18	-0.09	0.07	0.07	0.19	0.15	0.22	0.20	0.05	

Table A2

Currency strategies: gross returns

This table presents descriptive statistics of currency strategies formed using time $t - 1$ information. *CAR* is the carry trade strategy that buys (sells) the top 20% of all currencies with the highest (lowest) interest rate differential relative to the US dollar. Similarly, *MOM* is the momentum strategy that buys (sells) currencies with the highest (lowest) past three-month exchange rate return, *VAL* is the value strategy that buys (sells) currencies with lowest (highest) real exchange rate, *RR* is the risk reversal strategy that buys (sells) currencies with the lowest (highest) one-year 10 delta risk-reversal, and *VRP* is the volatility risk premium strategy that buys (sells) currencies with the highest (lowest) one-year volatility risk premium. The table also reports first order autocorrelation coefficient (*AC*), the annualized Sharpe ratio (*SR*), the Sortino ratio (*SO*), the percentage maximum drawdown (*MDD*), the frequency of portfolio switches for the long (*Freq_L*) and the short (*Freq_S*) position. Panel A displays the currency excess returns, and Panel B reports the exchange rate return component. Panel C presents the sample correlations of the currency excess returns. *, **, and *** indicate statistical significance for the mean at the 10%, 5%, and 1%, respectively, based on Newey and West (1987) and Andrews (1991). Returns are expressed in percentage per annum and not adjusted for transaction costs. The sample covers monthly data from January 1998 to December 2013.

Strategies	Developed					Developed and Emerging				
	<i>CAR</i>	<i>MOM</i>	<i>VAL</i>	<i>RR</i>	<i>VRP</i>	<i>CAR</i>	<i>MOM</i>	<i>VAL</i>	<i>RR</i>	<i>VRP</i>
<i>Panel A: Currency Excess Returns</i>										
Mean	4.82*	1.61	4.39**	5.81*	5.63***	5.71**	1.02	3.18	5.14*	5.01**
St. dev.	10.73	9.81	8.98	11.50	8.14	9.26	8.17	8.22	10.19	8.14
Skew	-0.71	0.26	-0.16	-0.47	-0.02	-0.65	0.07	-0.45	-0.51	0.02
Kurt	5.24	3.75	3.71	5.42	3.96	4.21	3.80	5.00	5.25	4.56
SR	0.45	0.16	0.49	0.51	0.69	0.62	0.13	0.39	0.50	0.62
SO	0.57	0.29	0.77	0.71	1.06	0.87	0.20	0.56	0.64	0.92
MDD	-37.0	-21.8	-13.9	-34.5	-14.3	-27.8	-17.3	-13.9	-31.0	-22.6
AC	0.08	-0.02	-0.02	0.08	0.05	0.05	-0.09	-0.09	0.09	-0.02
Freq _L	0.10	0.48	0.09	0.08	0.29	0.14	0.51	0.08	0.16	0.28
Freq _S	0.07	0.44	0.07	0.22	0.35	0.16	0.47	0.06	0.21	0.27
<i>Panel B: Exchange Rate Returns</i>										
Mean	-0.73	1.31	2.22	1.97	5.69***	-1.43	0.83	0.58	0.40	5.54***
St. dev.	10.76	9.86	9.03	11.59	8.12	9.28	8.17	8.26	10.27	8.20
Skew	-0.73	0.33	-0.24	-0.49	-0.03	-0.72	0.10	-0.53	-0.54	0.10
Kurt	5.43	3.94	3.75	5.64	4.05	4.35	4.06	5.21	5.63	5.10
SR	-0.07	0.13	0.25	0.17	0.70	-0.15	0.10	0.07	0.04	0.68
SO	-0.09	0.24	0.37	0.23	1.06	-0.21	0.17	0.10	0.05	1.02
MDD	-43.2	-22.7	-22.3	-40.3	-13.6	-37.0	-17.5	-20.6	-37.6	-17.2
AC	0.09	-0.01	-0.02	0.09	0.04	0.08	-0.10	-0.08	0.10	-0.02
Freq _L	0.10	0.48	0.09	0.08	0.29	0.14	0.51	0.08	0.16	0.28
Freq _S	0.07	0.44	0.07	0.22	0.35	0.16	0.47	0.06	0.21	0.27
<i>Panel C: Correlations</i>										
<i>CAR</i>	1.00	-0.20	0.30	0.76	-0.08	1.00	-0.07	0.32	0.59	-0.06
<i>MOM</i>	-0.20	1.00	-0.20	-0.23	0.11	-0.07	1.00	-0.19	-0.17	0.15
<i>VAL</i>	0.30	-0.20	1.00	0.46	0.19	0.32	-0.19	1.00	0.57	-0.03
<i>RR</i>	0.76	-0.23	0.46	1.00	0.10	0.59	-0.17	0.57	1.00	0.09
<i>VRP</i>	-0.08	0.11	0.19	0.10	1.00	-0.06	0.15	-0.03	0.09	1.00

Table A3

Decomposition of the volatility risk premium strategy

This table presents results on the Hassan and Mano (2014) decomposition of the covariance between volatility risk premia and future excess returns is decomposed into a ‘static’ (STA), ‘dynamic’ (DYN), and ‘dollar’ (DOL) component. Combining the static and dynamic trade yields a cross-sectional currency portfolio (CRS) which exploits persistent differences in the cross-section of countries’ volatility risk premia for forecasting and portfolio formation, whereas combining the dynamic and dollar trade yields a time-series portfolio (TMS) which exploits variation in countries’ volatility risk premia over time for forecasting and portfolio formation. The table also reports first order autocorrelation coefficient (*AC*), the annualized Sharpe ratio (*SR*), the Sortino ratio (*SO*), and the percentage maximum drawdown (*MDD*) position. Panel A displays the currency excess return, and Panel B reports the exchange rate return component. Panel C presents the sample correlations of the currency excess returns. Returns are expressed in percentage per annum and not adjusted for transaction costs. The sample covers monthly data from January 1998 to December 2013.

Strategies	Developed					Developed and Emerging				
	<i>STA</i>	<i>DYN</i>	<i>DOL</i>	<i>CRS</i>	<i>TMS</i>	<i>STA</i>	<i>DYN</i>	<i>DOL</i>	<i>CRS</i>	<i>TMS</i>
<i>Panel A: Currency Excess Returns</i>										
Mean	3.51	3.82	2.59	7.33	6.41	3.28	0.49	2.54	3.77	3.03
St. dev.	9.50	8.69	8.47	11.60	11.21	8.53	8.21	8.45	11.55	10.52
Skew	-0.35	0.25	-0.17	-0.07	0.19	-0.16	0.28	-0.45	0.59	0.00
Kurt	3.07	3.50	3.87	4.83	3.72	4.47	4.47	4.27	6.69	4.80
SR	0.37	0.44	0.31	0.63	0.57	0.38	0.06	0.30	0.33	0.29
SO	0.55	0.76	0.47	0.92	1.02	0.55	0.10	0.42	0.50	0.43
MDD	0.21	0.22	0.22	0.23	0.27	0.18	0.34	0.24	0.25	0.31
AC	0.07	0.14	0.05	-0.05	0.13	-0.09	0.18	0.08	-0.02	0.15
<i>Panel B: Exchange Rate Returns</i>										
Mean	0.65	4.62	2.29	5.27	6.91	2.92	1.13	1.89	4.06	3.02
St. dev.	9.56	8.70	8.42	11.54	11.17	8.60	8.22	8.40	11.70	10.47
Skew	-0.33	0.29	-0.19	-0.10	0.14	-0.08	0.37	-0.51	0.75	-0.04
Kurt	3.03	3.62	3.89	4.85	3.76	4.66	4.74	4.40	7.46	5.11
SR	0.07	0.53	0.27	0.46	0.62	0.34	0.14	0.22	0.35	0.29
SO	0.10	0.92	0.41	0.65	1.09	0.49	0.23	0.31	0.55	0.43
MDD	0.27	0.19	0.23	0.26	0.28	0.20	0.28	0.25	0.22	0.32
AC	0.08	0.13	0.05	-0.05	0.12	-0.08	0.17	0.07	-0.01	0.14
<i>Panel C: Correlations</i>										
<i>STA</i>	1.00	-0.19	0.15	0.68	-0.04	1.00	-0.05	0.30	0.70	0.20
<i>DYN</i>	-0.19	1.00	-0.15	0.59	0.66	-0.05	1.00	-0.20	0.67	0.62
<i>DOL</i>	0.15	-0.15	1.00	0.01	0.64	0.30	-0.20	1.00	0.08	0.64
<i>CRS</i>	0.68	0.59	0.01	1.00	0.47	0.70	0.67	0.08	1.00	0.59
<i>TMS</i>	-0.04	0.66	0.64	0.47	1.00	0.20	0.62	0.64	0.59	1.00
<i>VRP</i>	0.13	0.80	-0.09	0.71	0.55	0.43	0.66	0.20	0.78	0.67

Table A4

Breakdown of volatility risk premia portfolios.

The table presents the number of times a given currency enters the corner portfolios of the volatility risk premia portfolios. P_L denotes the long portfolio whereas P_S is the short portfolio. The sample covers monthly data from January 1998 to December 2013.

Currencies	<i>AUD</i>	<i>CAD</i>	<i>CHF</i>	<i>DKK</i>	<i>EUR</i>	<i>GBP</i>	<i>JPY</i>	<i>NOK</i>	<i>NZD</i>	<i>SEK</i>	<i>BRL</i>	<i>CZK</i>	<i>HUF</i>	<i>KRW</i>	<i>MXN</i>	<i>PLN</i>	<i>SGD</i>	<i>TRY</i>	<i>TWD</i>	<i>ZAR</i>	
<i>Panel A: Developed</i>																					
P_L	92	44	53	4	7	15	58	37	54	38											
P_S	21	36	9	55	59	67	65	42	32	42											
<i>Panel B: Developed and Emerging</i>																					
P_L	94	46	50	4	6	15	59	32	52	33	9	14	16	6	0	47	8	1	5	0	
P_S	2	13	9	26	26	46	51	34	10	35	42	3	18	36	55	9	13	39	91	0	

Table A5

Beta-sorted portfolios: principal component of volatility risk premia

This table presents descriptive statistics of beta-sorted currency portfolios. Each beta is obtained by regressing individual currency excess returns on the first principal component of volatility risk premia using a 36-month moving window. The long (short) portfolio P_L (P_S) contains the top 20% of all currencies with the lowest (highest) beta. L/S denotes a strategy that is long P_L and short P_S . The table also reports the first order autocorrelation coefficient (AC), the annualized Sharpe ratio (SR), and the frequency of portfolio switches ($Freq$). Panel A displays the currency excess returns, and Panel B reports the exchange rate component. Panel C presents the pre- and post-formation β s, and the pre- and post-formation interest rate differential (if) relative to the US dollar. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively, based on Newey and West (1987) and Andrews (1991). Returns are expressed in percentage per annum and adjusted for transaction costs. The sample runs from January 1998 to December 2013.

Portfolios	Developed						Developed and Emerging					
	P_L	P_2	P_3	P_4	P_S	L/S	P_L	P_2	P_3	P_4	P_S	L/S
<i>Panel A: Currency excess returns</i>												
Mean	3.85	2.40	3.02	2.75	8.88***	-5.02*	3.93*	3.12	3.62	2.48	7.31**	-3.37
St. dev.	9.14	10.59	9.23	10.38	11.91	10.67	8.12	9.55	10.03	10.12	12.16	10.97
Skew	0.36	-0.09	-0.67	-0.26	-0.51	0.86	0.20	0.22	-0.42	-0.59	-0.87	1.00
Kurt	3.42	4.43	5.24	4.47	5.35	7.35	2.97	5.17	4.32	4.71	5.93	6.59
SR	0.42	0.23	0.33	0.27	0.75	-0.47	0.48	0.33	0.36	0.24	0.60	-0.31
AC	0.06	-0.02	0.17	-0.01	0.01	0.06	0.10	-0.01	0.05	0.01	0.02	-0.05
Freq	0.16	0.24	0.28	0.29	0.11	0.11	0.10	0.18	0.28	0.25	0.12	0.12
<i>Panel B: Exchange rate returns</i>												
Mean	4.62*	2.56	2.63	2.05	6.25*	-1.63	4.66**	3.10	2.90	1.46	4.55	0.11
St. dev.	9.14	10.56	9.28	10.31	11.93	10.77	8.09	9.55	9.98	10.10	12.14	11.01
Skew	0.38	-0.10	-0.69	-0.28	-0.53	0.95	0.19	0.22	-0.43	-0.67	-0.94	1.12
Kurt	3.48	4.38	5.23	4.53	5.35	7.56	2.95	5.16	4.29	4.76	6.06	6.96
SR	0.51	0.24	0.28	0.20	0.52	-0.15	0.58	0.32	0.29	0.15	0.37	0.01
AC	0.05	-0.03	0.18	-0.02	0.01	0.07	0.09	-0.01	0.04	0.00	0.02	-0.05
Freq	0.16	0.24	0.28	0.29	0.11	0.11	0.10	0.18	0.28	0.25	0.12	0.12
<i>Panel C: Portfolio formation</i>												
<i>pre-if</i>	-0.53	0.05	0.59	0.97	2.32		-0.47	0.24	0.96	1.27	2.35	
<i>post-if</i>	-0.53	0.05	0.56	0.97	2.26		-0.51	0.25	0.95	1.23	2.29	
<i>pre-β</i>	-0.13	-0.05	0.01	0.08	0.18		-0.14	-0.04	0.06	0.15	0.29	
<i>post-β</i>	-0.07	-0.03	0.06***	0.01	0.04**		-0.08***	-0.05*	0.02	0.01	0.04**	

Table A6

Beta-sorted portfolios: equity volatility risk premium

This table presents descriptive statistics of beta-sorted currency portfolios. Each beta is obtained by regressing individual currency excess returns on the US equity volatility risk premium using a 36-month moving window. The long (short) portfolio P_L (P_S) contains the top 20% of all currencies with the lowest (highest) beta. L/S denotes a strategy that is long P_L and short P_S . The table also reports the first order autocorrelation coefficient (AC), the annualized Sharpe ratio (SR), and the frequency of portfolio switches ($Freq$). Panel A displays the currency excess returns, and Panel B reports the exchange rate component. Panel C presents the pre- and post-formation β s, and the pre- and post-formation interest rate differential (if) relative to the US dollar. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively, based on Newey and West (1987) and Andrews (1991). Returns are expressed in percentage per annum and adjusted for transaction costs. The sample runs from January 1998 to December 2013.

Portfolios	Developed						Developed and Emerging					
	P_L	P_2	P_3	P_4	P_S	L/S	P_L	P_2	P_3	P_4	P_S	L/S
<i>Panel A: Currency excess returns</i>												
Mean	4.60	4.76*	4.40	2.28	4.89**	-0.28	4.33	4.96*	3.36	3.74	4.11*	0.22
St. dev.	10.41	10.38	10.07	10.65	8.80	9.43	10.38	9.78	10.14	10.13	8.77	8.88
Skew	-0.29	-0.45	-0.30	-0.39	0.20	-1.09	-0.59	-0.74	-0.36	0.17	-0.42	-1.07
Kurt	4.81	5.59	4.53	4.82	4.08	6.12	5.89	5.78	4.34	5.26	3.77	7.05
SR	0.44	0.46	0.44	0.21	0.56	-0.03	0.42	0.51	0.33	0.37	0.47	0.03
AC	0.17	0.08	0.04	0.00	-0.06	0.13	0.17	0.12	0.00	0.00	-0.11	0.15
Freq	0.19	0.37	0.36	0.30	0.15	0.15	0.20	0.35	0.41	0.35	0.17	0.17
<i>Panel B: Exchange rate returns</i>												
Mean	2.99	4.00	3.90	2.17	4.99**	-2.00	2.43	4.12	2.61	3.80	3.86*	-1.43
St. dev.	10.39	10.37	10.06	10.65	8.84	9.52	10.33	9.78	10.10	10.07	8.81	8.88
Skew	-0.31	-0.47	-0.31	-0.39	0.19	-1.12	-0.65	-0.77	-0.37	0.18	-0.47	-1.13
Kurt	4.88	5.55	4.52	4.75	4.15	6.33	6.02	5.79	4.25	5.36	3.89	7.18
SR	0.29	0.39	0.39	0.20	0.56	-0.21	0.23	0.42	0.26	0.38	0.44	-0.16
AC	0.16	0.08	0.04	0.00	-0.06	0.13	0.16	0.13	0.00	0.00	-0.10	0.15
Freq	0.19	0.37	0.36	0.30	0.15	0.15	0.20	0.35	0.41	0.35	0.17	0.17
<i>Panel C: Portfolio formation</i>												
<i>pre-if</i>	1.83	0.96	0.71	0.33	-0.41		2.13	1.05	0.93	0.18	-0.09	
<i>post-if</i>	1.81	0.95	0.70	0.30	-0.45		2.10	1.03	0.94	0.17	-0.17	
<i>pre-β</i>	-0.20	-0.12	-0.07	0.00	0.11		-0.19	-0.12	-0.05	0.02	0.13	
<i>post-β</i>	-0.02	-0.01	0.01	0.01	0.01		-0.03	0.00	-0.02	0.02	0.00	

Table A7

Volatility spread strategies.

This table presents selected descriptive statistics of realized volatility spread (RVS_{LS}) strategies formed using time $t - 1$ information. The strategy buys (sells) the top 20% of all currencies with the highest (lowest) volatility spread defined as long-maturity (L) minus short-maturity (S) realized volatility. Realized volatilities are constructed using daily exchange rate returns. The table reports annualized Sharpe ratio based on the currency excess (exchange rate) returns in Panel A (Panel B), the sample correlation with the carry trade (CAR) strategy in Panel C, and the sample correlation with the volatility risk premium (VRP) strategy in Panel D. Returns are adjusted for transaction costs. The sample covers monthly data from January 1998 to December 2013.

	Developed					Developed and Emerging				
	L_{M6}	L_{M9}	L_{M12}	L_{M18}	L_{M24}	L_{M6}	L_{M9}	L_{M12}	L_{M18}	L_{M24}
<i>Panel A: Currency Excess Returns' Sharpe Ratios</i>										
S_{M1}	0.35	0.29	0.44	0.50	0.38	0.32	0.47	0.57	0.51	0.41
S_{M2}	0.48	0.49	0.47	0.42	0.41	0.37	0.44	0.45	0.35	0.37
S_{M3}	0.26	0.60	0.51	0.28	0.29	0.21	0.40	0.24	0.41	0.49
S_{M6}		0.15	0.07	0.20	0.04		0.29	0.21	0.26	0.16
<i>Panel B: Exchange Rate Returns' Sharpe Ratios</i>										
S_{M1}	0.37	0.33	0.48	0.52	0.39	0.30	0.47	0.57	0.49	0.39
S_{M2}	0.50	0.51	0.48	0.44	0.42	0.39	0.43	0.43	0.35	0.37
S_{M3}	0.29	0.62	0.54	0.31	0.30	0.23	0.40	0.27	0.43	0.50
S_{M6}		0.20	0.12	0.24	0.07		0.35	0.28	0.34	0.23
<i>Panel C: Correlation with CAR</i>										
S_{M1}	-0.11	-0.16	-0.22	-0.16	-0.19	-0.03	-0.08	-0.17	-0.06	-0.13
S_{M2}	-0.08	-0.10	-0.08	-0.08	-0.19	-0.04	-0.09	-0.07	-0.05	-0.16
S_{M3}	-0.22	-0.18	-0.10	-0.08	-0.18	-0.17	-0.10	-0.08	-0.09	-0.16
S_{M6}		-0.09	-0.02	-0.05	-0.08		0.03	-0.05	-0.09	-0.16
<i>Panel D: Correlation with VRP</i>										
S_{M1}	0.14	0.27	0.27	0.18	0.11	0.12	0.26	0.32	0.24	0.15
S_{M2}	0.27	0.28	0.29	0.20	0.06	0.27	0.31	0.34	0.27	0.21
S_{M3}	0.34	0.35	0.34	0.22	0.09	0.35	0.34	0.34	0.21	0.15
S_{M6}		0.16	0.10	-0.02	-0.17		0.25	0.24	0.06	0.00

Table A8

Asset pricing tests: illiquidity

This table reports asset pricing tests for a linear factor model that includes the dollar (DOL), the spot market global illiquidity (BAS_{FX}), and the option market global illiquidity (BAS_{IV}) factors. DOL is equivalent to a strategy that borrows in the US money market and equally invests in all foreign currencies, and serves as a constant in the cross-section. BAS_{FX} is computed as the innovations to a first order autoregressive process applied to the average bid-ask spread of the spot exchange rate. BAS_{IV} is computed as the innovations to a first order autoregressive process applied to the average bid-ask spread of the one-year at-the-money implied volatility. The test assets are excess returns to five currency portfolios sorted on the one-year volatility risk premium at time $t - 1$. Panel A reports Generalized method of moments (GMM) and Fama-MacBeth (FMB) estimates of the market price of risk λ , and the Hansen-Jagannathan distance HJ test for the null hypothesis that the pricing errors are jointly zero. Panel B reports least-squares estimates of time series regressions and the χ^2 test for the null that all intercepts are jointly zero. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively, based on Newey and West (1987) and Andrews (1991) for GMM estimates, and Shanken (1992) for FMB estimates. Returns are annualized and adjusted for transaction costs. The sample covers monthly data from January 1998 to December 2013.

<i>Panel A: Cross section</i>								
Estimates	Developed				Developed and Emerging			
	λ_{DOL}	λ_{FX}	R^2	HJ	λ_{DOL}	λ_{FX}	R^2	HJ
GMM_1	0.03	-0.17**	0.36	0.18	0.03	-1.78	0.62	0.13
GMM_2	0.03	-0.13	0.25		0.03	-1.59	0.56	
FMB	0.03	-0.17	0.36		0.03	-1.78	0.62	
Estimates	Developed				Developed and Emerging			
	λ_{DOL}	λ_{IV}	R^2	HJ	λ_{DOL}	λ_{IV}	R^2	HJ
GMM_1	0.02	-0.35	0.14	0.17	0.02	-0.74	0.32	0.16
GMM_2	0.02	-0.35	0.19		0.02	-0.44	0.20	
FMB	0.02	-0.35	0.14		0.02	-0.74	0.32	
<i>Panel B: Time series</i>								
Estimates	Developed				Developed and Emerging			
	α	β_{DOL}	β_{FX}	R^2	α	β_{DOL}	β_{FX}	R^2
P_L	0.03*	0.96***	-0.10	0.70	0.02*	1.05***	-0.01	0.75
P_2	0.01	0.98***	0.05	0.76	0.01	0.93***	< .01	0.80
P_3	-0.01	0.91***	-0.02	0.70	-0.01	0.98***	0.01	0.82
P_4	0.01	1.07***	0.04	0.80	< 0.01	1.16***	0.01	0.85
P_S	-0.03**	1.05***	0.07	0.75	-0.01	0.84***	< .01	0.71
χ^2	8.11				9.31*			
Estimates	Developed				Developed and Emerging			
	α	β_{DOL}	β_{IV}	R^2	α	β_{DOL}	β_{IV}	R^2
P_L	0.02*	0.94***	0.00	0.69	0.02*	1.05***	-0.01	0.75
P_2	0.01	0.98***	0.00	0.75	0.01	0.95***	0.01	0.81
P_3	-0.01	0.95***	-0.03	0.71	-0.01	0.98***	0.00	0.82
P_4	0.01	1.08***	0.01	0.80	0.00	1.16***	-0.01**	0.84
P_S	-0.03**	1.04***	0.04**	0.76	-0.01	0.86***	0.01*	0.71
χ^2	6.89				5.60			

Table A9

Arbitrage risk proxies and VRP

This table presents predictive regressions estimates. The dependent variable is the exchange rate return component of the *VRP* strategy at time t . This strategy is a long-short portfolio that buys (sells) the top 20% of all currencies with the highest (lowest) one-year volatility risk premia at time $t - 1$. The set of predictors is measured at time $t - 1$ and includes the TED spread, the VIX, the St. Louis Federal Reserve Bank Financial Stress Index (FSI), and the capital flows into hedge funds constructed as the asset under management (AUM) weighted net flows scaled by the lagged AUM as in Patton and Ramadorai (2013). Δ denotes the first-difference operator. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively, based on Newey and West (1987) and Andrews (1991). The exchange rate returns are annualized. The sample runs from January 1998 to December 2013.

α	Developed						Developed and Emerging						
	TED	Δ VIX	Δ FSI	TED \times Δ VIX	Flows	R^2	α	TED	Δ VIX	Δ FSI	TED \times Δ VIX	Flows	R^2
-0.02	0.15***					0.05	-0.02	0.15***					0.05
0.06***		< 0.01				< 0.01	0.06***		< 0.01				< 0.01
0.06***			0.07			< 0.01	0.06***			0.08*			< 0.01
0.06***				< 0.01		0.01	0.05***				< 0.01		< 0.01
0.07***					-1.59**	0.05	0.06***					-1.31	0.01
0.01	0.13***				-1.02	0.03	-0.01	0.14***				-0.69	0.05
0.07***		< 0.01			-1.59**	0.02	0.06***		< 0.01			-1.29	0.01
0.07***			0.05		-1.52*	0.02	0.06***			0.07		-1.24	0.02
0.06***				< 0.01	-1.53*	0.04	0.06***				< 0.01	-1.30	0.01
< .01	0.12***	< 0.01		< 0.01	-1.07	0.04	-0.03	0.17***	0.01		-0.01*	-0.57	0.05

Table A10

Currency strategies: VRP measures

This table presents descriptive statistics of currency strategies formed using time $t - 1$ information. CAR is the carry trade strategy that buys (sells) the top 20% of all currencies with the highest (lowest) interest rate differential relative to the US dollar whereas VRP is the volatility risk premium strategy that buys (sells) the top 20% of all currencies with the highest (lowest) one-year volatility risk premium. The one-year volatility risk premium is defined as the realized volatility (RV_t) minus the synthetic volatility swap rate (SW_t). The subscript cs indicates that SW_t is computed by interpolating implied volatilities via the cubic spline method (e.g., Jiang and Tian, 2005). This is the default approach used in the core analysis; atm indicates that SW_t is simply proxied by at-the-money implied volatility; vv indicates that SW_t is constructed by interpolating implied volatilities via the Vanna-Volga method (Castagna and Mercurio, 2007); and si indicates that SW_t is based on the simple variance swap method (Martin, 2012). The table also reports first order autocorrelation coefficient (AC), the annualized Sharpe ratio (SR), the Sortino ratio (SO), the percentage maximum drawdown (MDD), the frequency of portfolio switches for the long ($Freq_L$) and the short ($Freq_S$) position. *Panel A* displays the currency excess return whereas *Panel B* reports the exchange rate return component. *Panel C* presents the sample correlations of the currency excess returns. *, **, and *** indicate statistical significance for the mean at the 10%, 5%, and 1%, respectively, based on Newey and West (1987) and Andrews (1991). Returns are expressed in percentage per annum and adjusted for transaction costs. The sample covers monthly data from January 1998 to December 2013.

Strategies	Developed					Developed and Emerging				
	CAR	VRP_{cs}	VRP_{atm}	VRP_{vv}	VRP_{si}	CAR	VRP_{cs}	VRP_{atm}	VRP_{vv}	VRP_{si}
<i>Panel A: Currency excess returns</i>										
Mean	4.10	4.95**	5.01**	4.89**	4.74**	4.90**	4.16**	5.25***	3.13	4.06**
St. dev.	10.73	8.15	7.82	7.98	8.11	9.25	8.14	7.51	7.78	7.81
Skew	-0.71	-0.03	0.09	0.23	0.06	-0.65	0.01	-0.10	-0.16	-0.16
Kurt	5.25	3.97	3.58	3.68	3.53	4.21	4.54	4.08	4.10	3.98
SR	0.38	0.61	0.64	0.61	0.58	0.53	0.51	0.70	0.40	0.52
SO	0.49	0.93	1.04	1.07	0.93	0.74	0.76	1.07	0.60	0.78
MDD	0.38	0.17	0.14	0.18	0.16	0.28	0.24	0.15	0.26	0.22
AC	0.08	0.05	0.01	0.07	0.04	0.05	-0.02	-0.02	0.03	0.00
$Freq_L$	0.10	0.29	0.28	0.29	0.29	0.14	0.28	0.28	0.31	0.27
$Freq_S$	0.07	0.35	0.34	0.36	0.38	0.16	0.27	0.29	0.29	0.27
<i>Panel B: Exchange rate returns</i>										
Mean	-0.81	5.45***	5.37***	5.64***	4.81**	-1.61	5.27**	5.73***	4.39**	4.46**
St. dev.	10.76	8.12	7.77	7.93	8.06	9.29	8.20	7.53	7.78	7.78
Skew	-0.72	-0.03	0.06	0.24	0.02	-0.72	0.09	-0.11	-0.12	-0.17
Kurt	5.43	4.04	3.75	3.77	3.61	4.35	5.10	4.27	4.31	4.16
SR	-0.08	0.67	0.69	0.71	0.60	-0.17	0.64	0.76	0.56	0.57
SO	-0.10	1.01	1.10	1.23	0.93	-0.23	0.97	1.14	0.85	0.85
MDD	0.43	0.15	0.14	0.15	0.14	0.37	0.18	0.15	0.19	0.18
AC	0.09	0.04	0.01	0.06	0.02	0.08	-0.02	-0.03	0.01	-0.03
$Freq_L$	0.10	0.29	0.28	0.29	0.29	0.14	0.28	0.28	0.31	0.27
$Freq_S$	0.07	0.35	0.34	0.36	0.38	0.16	0.27	0.29	0.29	0.27
<i>Panel C: Correlations</i>										
CAR	1.00	-0.08	-0.04	-0.18	0.27	1.00	-0.06	0.02	-0.12	0.16
VRP	-0.08	1.00	0.88	0.91	0.80	-0.06	1.00	0.90	0.94	0.88
VRP_{atm}	-0.04	0.88	1.00	0.87	0.77	0.02	0.90	1.00	0.86	0.90
VRP_{vv}	-0.18	0.91	0.87	1.00	0.73	-0.12	0.94	0.86	1.00	0.85
VRP_{si}	0.27	0.80	0.77	0.73	1.00	0.16	0.88	0.90	0.85	1.00

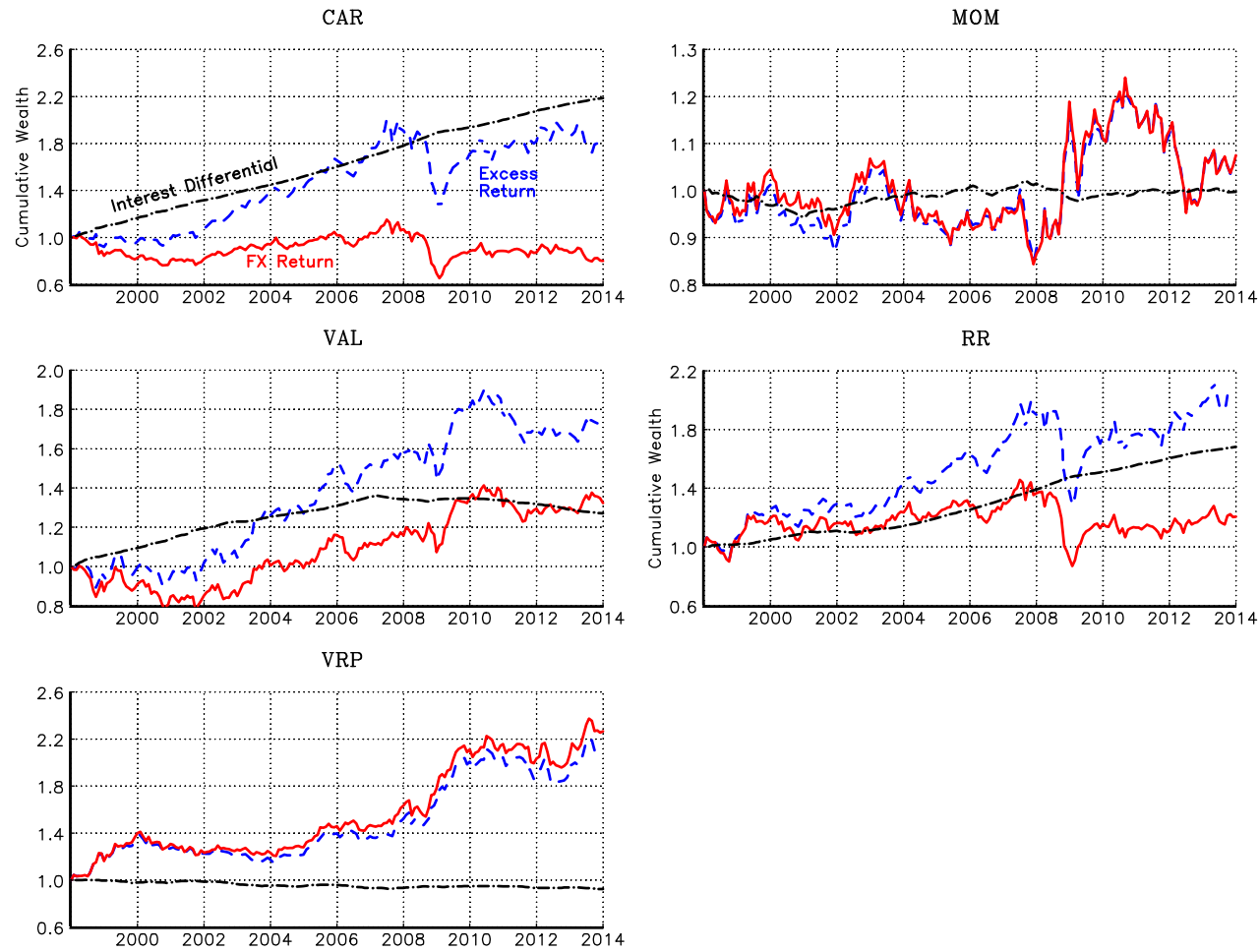


Fig. A1. Cumulative wealth: developed countries. The figure presents the cumulative wealth of currency strategies formed using $t - 1$ information. *CAR* is the carry strategy that buys (sells) the top 20% of all currencies with the highest (lowest) interest rate differential relative to the US dollar. Similarly, *MOM* is the momentum strategy that buys (sells) currencies with the highest (lowest) past three-month exchange rate return, *VAL* is the value strategy that buys (sells) currencies with lowest (highest) real exchange rate, *RR* is the risk reversal strategy that buys (sells) currencies with the lowest (highest) one-year 10 delta risk-reversal, and *VRP* is the volatility risk premium strategy that buys (sells) currencies with the highest (lowest) one-year volatility risk premium. Excess returns are adjusted for transaction costs. The sample period covers monthly data from January 1998 to December 2013.

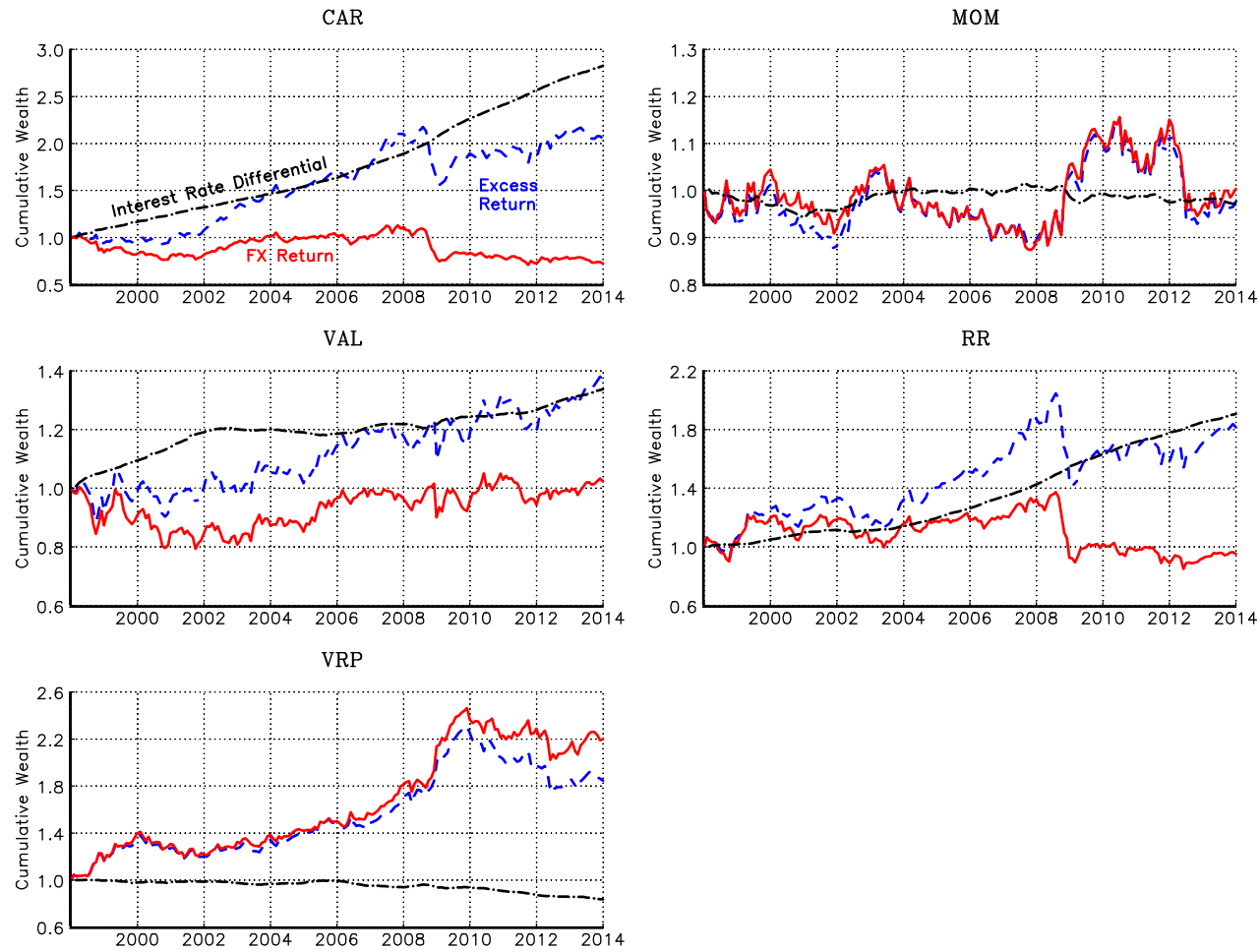


Fig. A2. Cumulative wealth: developed and emerging countries. The figure presents the cumulative wealth of currency strategies formed using $t - 1$ information. *CAR* is the carry strategy that buys (sells) the top 20% of all currencies with the highest (lowest) interest rate differential relative to the US dollar. Similarly, *MOM* is the momentum strategy that buys (sells) currencies with the highest (lowest) past three-month exchange rate return, *VAL* is the value strategy that buys (sells) currencies with lowest (highest) real exchange rate, *RR* is the risk reversal strategy that buys (sells) currencies with the lowest (highest) one-year 10 delta risk-reversal, and *VRP* is the volatility risk premium strategy that buys (sells) currencies with the highest (lowest) one-year volatility risk premium. Excess returns are adjusted for transaction costs. The sample period covers monthly data from January 1998 to December 2013.