Internet Appendix

to

Global Currency Hedging with Common Risk Factors

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Table A.1: Comparison of Currency Hedging Weights
The table presents the currency-specific proportion of the *out-of-sample* period from January 1997 to July 2017, in which the hedge ratios used in Dynamic Currency Factor (*DCF*) hedging are the same as those in the *carry*, *value*, and *momentum* (mom) approaches to currency hedging. We also present the proportion of the sample in which the hedge ratios in the *DCF* strategy are the same as at least one of those alternative approaches. Results are presented for equal-weighted equity and bond portfolios (Panel A), and GDP-weighted portfolios (Panel B). We also present the mean (*average*) across currency pairs.

Panel A: Equal-Weighted Portfolio

	Global Equity Portfolios				*Global Bond Portfolios*			
	Carry	Value	Mom	All	Carry	Value	Mom	All
German DM/euro	68	34	61	91	63	42	64	92
Japanese yen	82	21	57	95	93	22	59	98
British pound	53	48	60	90	56	53	61	92
Canadian dollar	49	39	65	89	57	34	62	90
Australian dollar	62	38	68	94	70	38	68	96
Swiss franc	62	43	59	91	66	45	61	93
Swedish Krona	56	44	68	92	64	45	68	95
Norwegian Krone	51	31	68	89	61	38	71	94
New Zealand dollar	65	36	68	94	70	39	70	97
Average	61	37	64	92	67	40	65	94

Panel B: GDP-Weighted Portfolio

	Global Equity Portfolios				*Global Bond Portfolios*			
	Carry	Value	Mom	All	Carry	Value	Mom	All
German DM/euro	67	33	61	89	62	42	64	91
Japanese yen	72	21	52	85	91	21	57	96
British pound	54	46	61	89	55	51	61	90
Canadian dollar	51	39	66	89	56	34	62	89
Australian dollar	64	36	70	94	71	38	68	96
Swiss franc	62	43	58	91	64	43	62	93
Swedish Krona	56	44	68	93	63	45	68	96
Norwegian Krone	54	32	70	91	61	38	70	94
New Zealand dollar	68	37	70	96	70	41	70	98
Average	61	37	64	91	66	39	65	94

Table A.2: Alternative Out-of-Sample Periods

The table presents statistical and economic performance measures for global equity and bond portfolios when hedged using Dynamic Currency Factor (*DCF*) hedging. We report results for three *out-of-sample* periods beginning in either January 1997 (DCF), January 1992, or January 2002, and ending in July 2017. We report the portfolio mean, standard deviation (*std*), Sharpe ratio (*Sharpe*), and the difference in Sharpe ratio relative to the baseline *DCF* approach (Δ*Sharpe*). We also report economic performance criteria, including the certainty-equivalent return (CEQ), and the difference in certainty-equivalent return relative to the baseline *DCF* approach (ΔCEQ).

Panel A: Equal-Weighted Portfolio

	Global Equity Portfolios			*Global Bond Portfolios*		
	DCF	1992	2002	DCF	1992	2002
	Statistical performance evaluation					
mean (%)	7.93	8.12	9.14	5.21	5.47	6.51
std (%)	15.3	14.8	15.1	6.81	6.86	7.09
Sharpe	0.52	0.55	0.61	0.77	0.80	0.92
Δ*Sharpe*	-	0.03	0.09	-	0.03	0.15
	Economic performance evaluation					
CEQ	4.40	4.84	5.74	4.52	4.76	5.75
ΔCEQ	-	0.44	1.34	-	0.24	1.23

Panel B: GDP-Weighted Portfolio

	Global Equity Portfolios			*Global Bond Portfolios*		
	DCF	1992	2002	DCF	1992	2002
	Statistical performance evaluation					
mean (%)	6.16	5.87	7.19	4.16	4.61	4.71
std (%)	15.3	14.8	15.2	5.53	6.00	5.77
Sharpe	0.40	0.40	0.47	0.75	0.77	0.82
Δ*Sharpe*	-	0.00	0.07	-	0.02	0.07
	Economic performance evaluation					
CEQ	2.66	2.58	3.74	3.70	4.07	4.21
ΔCEQ	-	-0.08	1.08	-	0.37	0.51

Table A.3: Alternative Expanding Windows

The table presents statistical and economic performance measures for global equity and bond portfolios when hedged using one of three approaches to Dynamic Currency Factor (*DCF*) hedging. The results reflect the *out-of-sample* period from January 1997 to July 2017. In Panel A (Panel B), we report the results for equal-weighted (GDP-weighted) equity and bond portfolios. The first column presents results for the baseline Dynamic Currency Factor (*DCF*) hedging, in which the in-sample period is from January 1987 to December 1996. In the second and third columns the in-sample period begins in 1989 and 1992, respectively. We report the portfolio mean, standard deviation (*std*), Sharpe ratio (*Sharpe*), and the difference in Sharpe ratio relative to the baseline *DCF* approach (Δ*Sharpe*). We also report economic performance criteria, including the certainty-equivalent return (CEQ), difference in certainty-equivalent return relative to the baseline *DCF* approach (ΔCEQ), and performance fee a risk averse investor would pay for a manager to switch from each hedging framework to the baseline *DCF* approach, assuming the investor either has a risk aversion coefficient of two (ϕ_2) or six (ϕ_6). The superscripts *,**,*** represent statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Equal-Weighted Portfolio

	Global Equity Portfolios			*Global Bond Portfolios*		
	DCF	1989	1992	DCF	1989	1992
	Statistical performance evaluation					
mean (%)	7.93	7.85	7.26	5.21	5.29	4.54
std (%)	15.3	15.4	15.3	6.81	6.86	6.82
Sharpe	0.52	0.51	0.48	0.77	0.77	0.67
Δ*Sharpe*	-	-0.01	-0.04	-	0.00	-0.10
	Economic performance evaluation					
CEQ	4.40	4.30	3.77	4.52	4.58	3.84
ΔCEQ	-	-0.1	-0.63	-	0.06	-0.68
ϕ_2	-	0.08	0.66	-	-0.08	0.67
ϕ_6	-	0.08	0.65	-	-0.08	0.67

Panel B: GDP-Weighted Portfolio

	Global Equity Portfolios			*Global Bond Portfolios*		
	DCF	1989	1992	DCF	1989	1992
	Statistical performance evaluation					
mean (%)	6.16	6.10	5.83	4.16	4.14	3.90
std (%)	15.3	15.3	15.16	5.53	5.62	5.98
Sharpe	0.40	0.40	0.38	0.75	0.74	0.65
Δ*Sharpe*	-	0.00	-0.02	-	-0.01	-0.10
	Economic performance evaluation					
CEQ	2.66	2.60	2.39	3.70	3.67	3.36
ΔCEQ	-	-0.06	-0.27	-	-0.03	-0.34
ϕ_2	-	0.06	0.31	-	0.02	0.28
ϕ_6	-	0.06	0.31	-	0.02	0.28

Table A.4: Alternative Rolling Windows

The table presents statistical and economic performance measures for global equity and bond portfolios when hedged using one of three approaches to Dynamic Currency Factor (*DCF*) hedging. The results reflect the *out-of-sample* period from January 1997 to July 2017. In Panel A (Panel B), we report the results for equal-weighted (GDP-weighted) equity and bond portfolios. The first column presents results for the baseline Dynamic Currency Factor (*DCF*) hedging, in which factor betas are estimated over a 60-months rolling window. In columns two and three, betas are estimated over an 84-months and 120-months rolling window, respectively. We report the portfolio mean, standard deviation (*std*), Sharpe ratio (*Sharpe*), and the difference in Sharpe ratio relative to the baseline *DCF* approach (Δ*Sharpe*). We also report economic performance criteria, including the certainty-equivalent return (CEQ), difference in certainty-equivalent return relative to the baseline *DCF* approach (ΔCEQ), and performance fee a risk averse investor would pay for a manager to switch from each hedging framework to the baseline *DCF* approach, assuming the investor either has a risk aversion coefficient of two (ϕ_2) or six (ϕ_6). The superscripts *,**,*** represent statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Equal-Weighted Portfolio

	Global Equity Portfolios			*Global Bond Portfolios*		
	DCF	84 months	120 months	DCF	84 months	120 months
	Statistical performance evaluation					
mean (%)	7.93	7.84	7.68	5.21	5.25	5.21
std (%)	15.3	15.3	15.3	6.81	6.79	6.80
Sharpe	0.52	0.51	0.50	0.77	0.77	0.77
Δ*Sharpe*	-	-0.01	-0.02*	-	0.00	0.00
	Economic performance evaluation					
CEQ	4.40	4.32	4.17	4.52	4.56	4.51
ΔCEQ	-	-0.08	-0.23	-	0.04	-0.01
ϕ_2	-	0.08	0.24	-	-0.04	0.01
ϕ_6	-	0.08	0.24	-	-0.04	0.01

Panel B: GDP-Weighted Portfolio

	Global Equity Portfolios			*Global Bond Portfolios*		
	DCF	84 months	120 months	DCF	84 months	120 months
	Statistical performance evaluation					
mean (%)	6.16	6.11	6.05	4.16	4.11	4.20
std (%)	15.3	15.3	15.3	5.53	5.55	5.55
Sharpe	0.40	0.40	0.40	0.75	0.74	0.76
Δ*Sharpe*	-	0.00	0.00	-	-0.01	0.01
	Economic performance evaluation					
CEQ	2.66	2.60	2.56	3.70	3.65	3.74
ΔCEQ	-	-0.06	-0.10	-	-0.05	0.04
ϕ_2	-	0.05	0.10	-	0.05	-0.04
ϕ_6	-	0.05	0.10	-	0.05	-0.04

Table A.5: Alternative Factor Return Estimation

The table presents statistical and economic performance measures for global equity and bond portfolios when hedged using one of three approaches to Dynamic Currency Factor (*DCF*) hedging. The results reflect the *out-of-sample* period from January 1997 to July 2017. In Panel A (Panel B), we report the results for equal-weighted (GDP-weighted) equity and bond portfolios. The first column presents results for the baseline Dynamic Currency Factor (*DCF*) hedging, in which factor returns are estimated using an expanding window. In columns two and three, factors are estimated using a 60-months and 120-months rolling window, respectively. We report the portfolio mean, standard deviation (*std*), Sharpe ratio (*Sharpe*), and the difference in Sharpe ratio relative to the baseline *DCF* approach (Δ*Sharpe*). We also report economic performance criteria, including the certainty-equivalent return (CEQ), difference in certainty-equivalent return relative to the basline *DCF* approach (ΔCEQ), and performance fee a risk averse investor would pay for a manager to switch from each hedging framework to the baseline *DCF* approach, assuming the investor either has a risk aversion coefficient of two (ϕ_2) or six (ϕ_6). The superscripts *,**,*** represent statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Equal-Weighted Portfolio

	Global Equity Portfolios			*Global Bond Portfolios*		
	DCF	60 months	120 months	DCF	60 months	120 months
	Statistical performance evaluation					
mean (%)	7.93	7.26	7.11	5.21	4.54	4.58
std (%)	15.3	15.3	15.7	6.81	6.82	6.97
Sharpe	0.52	0.48	0.45	0.77	0.67	0.66
Δ*Sharpe*	-	-0.04	-0.07*	-	-0.10	-0.11
	Economic performance evaluation					
CEQ	4.40	3.77	3.44	4.52	3.84	3.85
ΔCEQ	-	-0.63	-0.96*	-	-0.68	-0.67
ϕ_2	-	0.66	0.85	-	0.67	0.63
ϕ_6	-	0.65	0.86	-	0.67	0.64

Panel B: GDP-Weighted Portfolio

	Global Equity Portfolios			*Global Bond Portfolios*		
	DCF	60 months	120 months	DCF	60 months	120 months
	Statistical performance evaluation					
mean (%)	6.16	5.83	5.69	4.16	3.90	3.87
std (%)	15.3	15.2	15.4	5.53	5.98	5.90
Sharpe	0.40	0.38	0.37	0.75	0.65	0.66
Δ*Sharpe*	-	-0.02	-0.03	-	-0.10	-0.09
	Economic performance evaluation					
CEQ	2.66	2.39	2.13	3.70	3.36	3.35
ΔCEQ	-	-0.27	-0.53	-	-0.34	-0.35
ϕ_2	-	0.31	0.48	-	0.28	0.30
ϕ_6	-	0.31	0.48	-	0.28	0.31

Table A.6: Crises Periods

The table presents statistical and economic performance measures for equal-weighted global equity and bond portfolios when hedged using one of 10 currency hedging frameworks. The results reflect the *out-of-sample* period from January 1997 to July 2017. In Panel A, we report the results for equal-weighted equity and bond portfolios when removing three financial crises periods: the Asian financial crises (July 1997 - December 1998), the global financial crisis (July 2007 - March 2009), and the European sovereign debt crisis (May 2010 - December 2012). We also report results from removing each crisis separately in Panel B (Asian financial crisis), Panel C (global financial crisis), and Panel D (European sovereign debt crisis). The first column presents results for Dynamic Currency Factor (*DCF*) hedging. The remaining nine approaches are described in Section 4. We report the difference in Sharpe ratio relative to the *DCF* approach ($\Delta Sharpe$), and the difference in certainty-equivalent return relative to the *DCF* approach (ΔCEQ). The superscripts *,**,*** represent statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: All Crises

		Naive Hedges		*Characteristic Hedges*			*Mean-Var Optimized Hedges*			
	DCF	No Hedge	Full Hedge	Carry	Value	Mom.	UIP	Rnd Walk	Int Rates	Model Combo
				Equal-Weighted Equity Portfolio						
$\Delta Sharpe$	-	-0.32***	-0.21*	-0.11*	-0.31***	-0.17***	-0.20***	-0.07	-0.10	-0.07
ΔCEQ	-	-3.72***	-3.18***	-1.34*	-4.01***	-2.13***	-3.27***	-1.47*	-1.61*	-1.31*
				Equal-Weighted Bond Portfolio						
$\Delta Sharpe$	-	-0.48***	-0.47**	-0.16	-0.56***	-0.29**	-0.60***	-0.23**	-0.25**	-0.24**
ΔCEQ	-	-3.56***	-3.22***	-1.23*	-3.97***	-2.08***	-3.81***	-1.85**	-1.92**	-1.81**

Panel B: Asian Financial Crisis

		Naive Hedges		*Characteristic Hedges*			*Mean-Var Optimized Hedges*			
	DCF	No Hedge	Full Hedge	Carry	Value	Mom.	UIP	Rnd Walk	Int Rates	Model Combo
				Equal-Weighted Equity Portfolio						
$\Delta Sharpe$	-	-0.26***	-0.17*	-0.15**	-0.20**	-0.13**	-0.16**	-0.14*	-0.15**	-0.13*
ΔCEQ	-	-4.29***	-2.55**	-2.21**	-2.97***	-1.90***	-2.41**	-2.05**	-2.23**	-1.89**
				Equal-Weighted Bond Portfolio						
$\Delta Sharpe$	-	-0.50***	-0.31	-0.22	-0.42***	-0.24**	-0.40**	-0.27*	-0.31*	-0.29*
ΔCEQ	-	-3.45***	-2.73**	-1.53*	-2.97***	-1.75**	-3.19***	-2.10**	-2.29**	-2.11**

Panel C: Global Financial Crisis

		Naive Hedges		*Characteristic Hedges*			*Mean-Var Optimized Hedges*			
	DCF	No Hedge	Full Hedge	Carry	Value	Mom.	UIP	Rnd Walk	Int Rates	Model Combo
				Equal-Weighted Equity Portfolio						
$\Delta Sharpe$	-	-0.26***	-0.16*	-0.10*	-0.24***	-0.15***	-0.15**	-0.07	-0.09	-0.06
ΔCEQ	-	-3.57***	-2.60**	-1.28	-3.44***	-2.12***	-2.58***	-1.42	-1.56*	-1.10
				Equal-Weighted Bond Portfolio						
$\Delta Sharpe$	-	-0.46***	-0.29	-0.10	-0.49***	-0.26**	-0.40**	-0.14	-0.18	-0.17
ΔCEQ	-	-3.00***	-2.63**	-0.81	-3.32***	-1.84***	-3.15***	-1.44*	-1.55*	-1.42**

Panel D: European Sovereign Debt Crisis

		Naive Hedges		*Characteristic Hedges*			*Mean-Var Optimized Hedges*			
	DCF	No Hedge	Full Hedge	Carry	Value	Mom.	UIP	Rnd Walk	Int Rates	Model Combo
				Equal-Weighted Equity Portfolio						
$\Delta Sharpe$	-	-0.27***	-0.16*	-0.13**	-0.21***	-0.10*	-0.15**	-0.13**	-0.13*	-0.12*
ΔCEQ	-	-4.59***	-2.27**	-2.05***	-3.24***	-1.53**	-2.16**	-2.00***	-1.96**	-1.85**
				Equal-Weighted Bond Portfolio						
$\Delta Sharpe$	-	-0.56***	-0.26	-0.24*	-0.47***	-0.22*	-0.43***	-0.29**	-0.31*	-0.30**
ΔCEQ	-	-4.06***	-2.32**	-1.62**	-3.21***	-1.51**	-3.08***	-2.06***	-2.14**	-2.06**

Table A.7: Transaction Costs

The table presents statistical and economic performance measures for global equity and bond portfolios when hedged using one of 10 currency hedging frameworks. Transaction costs (bid-ask spreads) are doubled relative to those used to produce the baseline results presented in Tables 3 and 4. The results reflect the *out-of-sample* period from January 1997 to July 2017. In Panel A (Panel B), we report the results for equal-weighted and GDP-weighted equity (bond) portfolios. The first column presents results for Dynamic Currency Factor (*DCF*) hedging. The remaining nine approaches are described in Section 4. We report the portfolio mean, Sharpe ratio (*Sharpe*), the difference in Sharpe ratio relative to the *DCF* approach (Δ*Sharpe*), the certainty-equivalent return (CEQ), and the difference in certainty-equivalent return relative to the *DCF* approach (ΔCEQ). The superscripts *,**,*** represent statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Global Equity Portfolio

		Naive Hedges		*Characteristic Hedges*			*Mean-Var Optimized Hedges*			
	DCF	No Hedge	Full Hedge	Carry	Value	Mom.	UIP	Rnd Walk	Int Rates	Model Combo
					Equal-Weighted Portfolio					
mean (%)	7.72	4.92	4.84	6.32	4.81	6.00	4.89	5.40	5.64	5.92
Sharpe	0.50	0.27	0.35	0.38	0.32	0.39	0.36	0.37	0.37	0.39
Δ*Sharpe*	-	-0.23***	-0.15*	-0.12**	-0.18***	-0.11**	-0.14**	-0.13**	-0.13*	-0.11*
CEQ	4.19	0.12	1.93	2.25	1.34	2.45	2.13	2.24	2.18	2.50
ΔCEQ	-	-4.07***	-2.26**	-1.94**	-2.85***	-1.74**	-2.06**	-1.95**	-2.01**	-1.69**
					GDP-Weighted Portfolio					
mean (%)	5.99	3.36	4.32	5.08	3.76	5.29	4.48	4.57	4.57	4.89
Sharpe	0.39	0.20	0.29	0.32	0.25	0.34	0.32	0.31	0.30	0.33
Δ*Sharpe*	-	-0.19**	-0.10	-0.07**	-0.14*	-0.05	-0.07	-0.08*	-0.09*	-0.06
CEQ	2.49	-0.84	1.10	1.32	0.27	1.75	1.58	1.39	1.02	1.54
ΔCEQ	-	-3.33***	-1.39*	-1.17*	-2.22**	-0.74	-0.91	-1.10*	-1.47*	-0.95

Panel B: Global Bond Portfolio

		Naive Hedges		*Characteristic Hedges*			*Mean-Var Optimized Hedges*			
	DCF	No Hedge	Full Hedge	Carry	Value	Mom.	UIP	Rnd Walk	Int Rates	Model Combo
					Equal-Weighted Portfolio					
mean (%)	5.02	2.33	2.26	3.74	2.23	3.42	1.70	3.01	2.93	3.12
Sharpe	0.74	0.25	0.49	0.55	0.32	0.51	0.37	0.50	0.46	0.48
Δ*Sharpe*	-	-0.49***	-0.25	-0.19	-0.42***	-0.23**	-0.37**	-0.24*	-0.28*	-0.26*
CEQ	4.32	1.06	1.94	3.03	1.51	2.75	1.39	2.47	2.31	2.48
ΔCEQ	-	-3.26***	-2.38**	-1.29	-2.81***	-1.57**	-2.93***	-1.85**	-2.01**	-1.84**
					GDP-Weighted Portfolio					
mean (%)	4.00	1.54	2.50	3.26	1.94	3.47	2.09	2.77	2.54	2.90
Sharpe	0.72	0.18	0.59	0.59	0.29	0.55	0.50	0.56	0.43	0.49
Δ*Sharpe*	-	-0.54***	-0.13	-0.13	-0.43**	-0.17	-0.22	-0.16	-0.29*	-0.23*
CEQ	3.54	0.47	2.23	2.79	1.25	2.87	1.83	2.40	2.02	2.38
ΔCEQ	-	-3.07***	-1.31	-0.75	-2.29**	-0.67	-1.71**	-1.14*	-1.52**	-1.16*

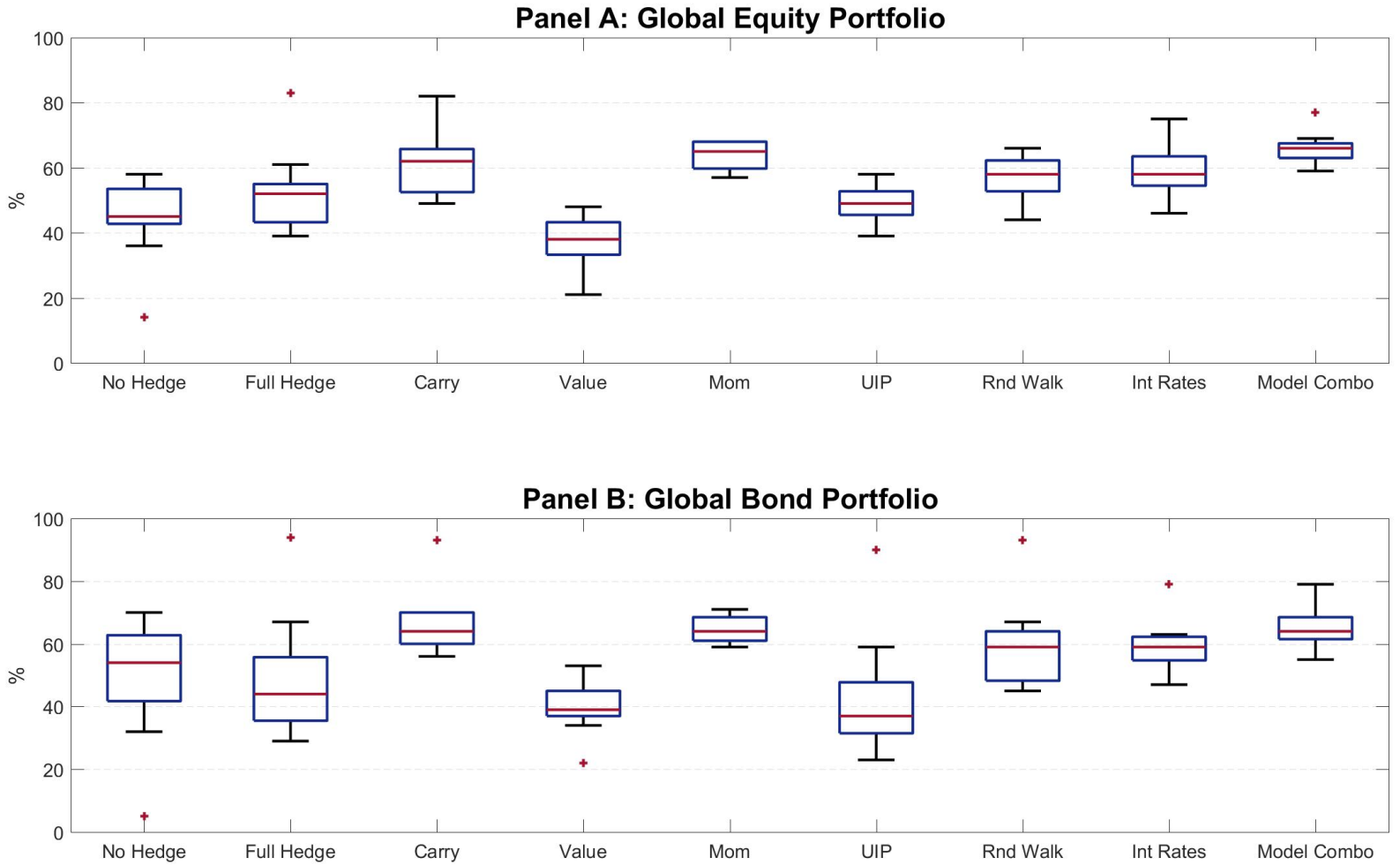

Figure A.1: Hedge Ratios
The figure presents box plots that report the proportion of the sample in which Dynamic Currency Factor (DCF) hedge ratios are the same as those in the other nine approaches to currency hedging. Each box contains information on the minimum and maximum proportions, as well as the 25th, 50th, and 75th percentiles across currencies, while crosses represent outliers. The distribution for equal-weighted global equity (bond) portfolios are reported in Panel A (Panel B). The results reflect the *out-of-sample* period from January 1997 to July 2017.

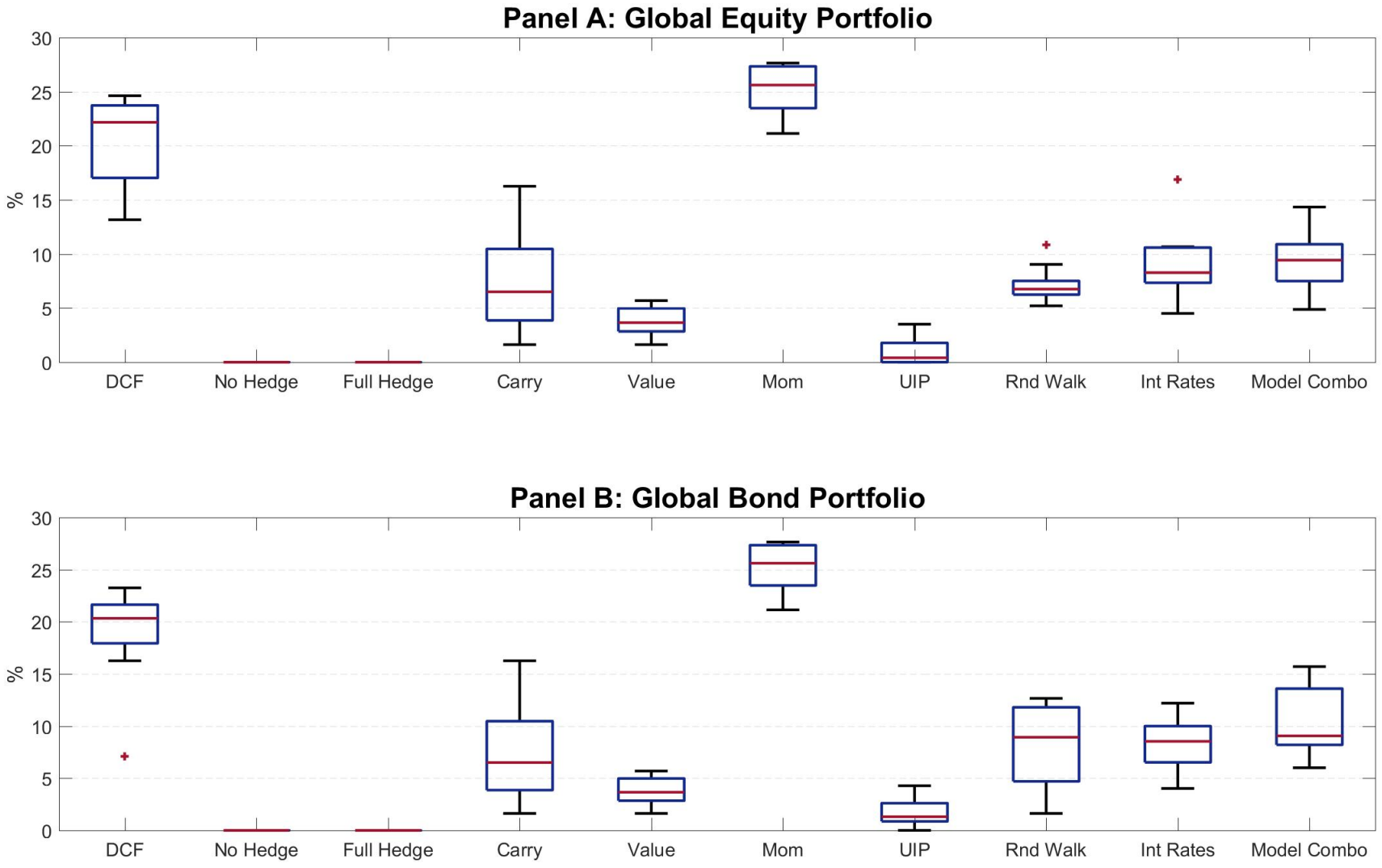

Figure A.2: Turnover in Hedge Ratios
The figure presents box plots that report the average turnover for Dynamic Currency Factor (*DCF*) hedging, as well as for the nine alternative approaches to currency hedging. Each box contains information on the minimum and maximum levels of turnover, as well as the 25th, 50th, and 75th percentiles across currencies, while crosses represent outliers. The distribution for equal-weighted global equity (bond) portfolios are reported in Panel A (Panel B). The results reflect the *out-of-sample* period from January 1997 to July 2017.