

Global Currency Hedging For Pension Funds

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Global Currency Hedging

- An academic research project with Karine Serfaty-de Medeiros and John Y. Campbell of Harvard.
- The bottom line: there are two types of currencies in the world.
 - Normal currencies (e.g. Australian dollar, Canadian dollar, Japanese yen, British pound) strengthen when world equity markets go up.
 - Reserve currencies (e.g. US dollar, the euro and Swiss franc) strengthen when world equity markets go down.
- Bond markets are largely uncorrelated with currencies.
- We identify reserve currencies from their correlations with equity markets and bond markets, but they are also widely held by central banks.

Global Currency Hedging

- Equity investors should hold reserve currencies and avoid normal currencies, unless they believe normal currencies offer a higher return.
 - For US or Euroland investors, currency exposures of international equity portfolios should be at least fully hedged, with the exception of the US dollar (for Euroland investors) or the euro and the Swiss franc (for US investors).
 - For investors whose home currency is a normal currency, for example a British investor, this means that foreign equity positions, particularly those in US and Euroland, should **not** be hedged.
- Bond investors should fully hedge their currency exposures, regardless of their home country, and regardless of whether they hold only domestic bonds or an international bond portfolio.

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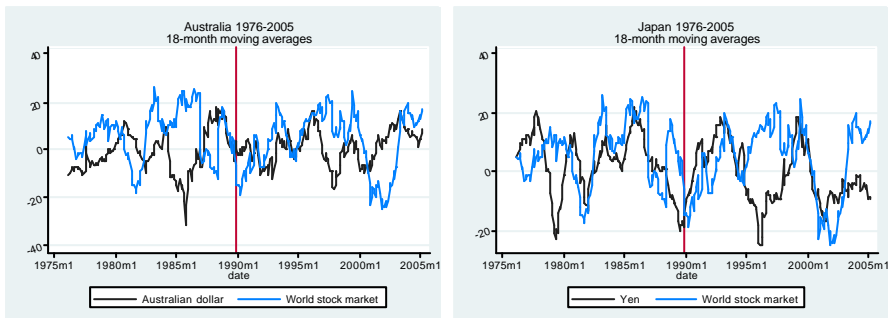


Fig. 1 and Fig 2: Currency and hedged world stock market excess returns

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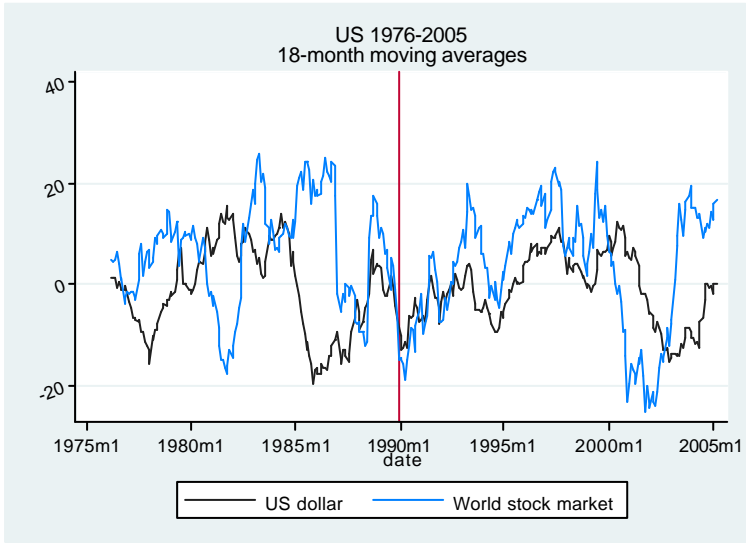


Fig. 5: Currency and hedged world stock market excess returns

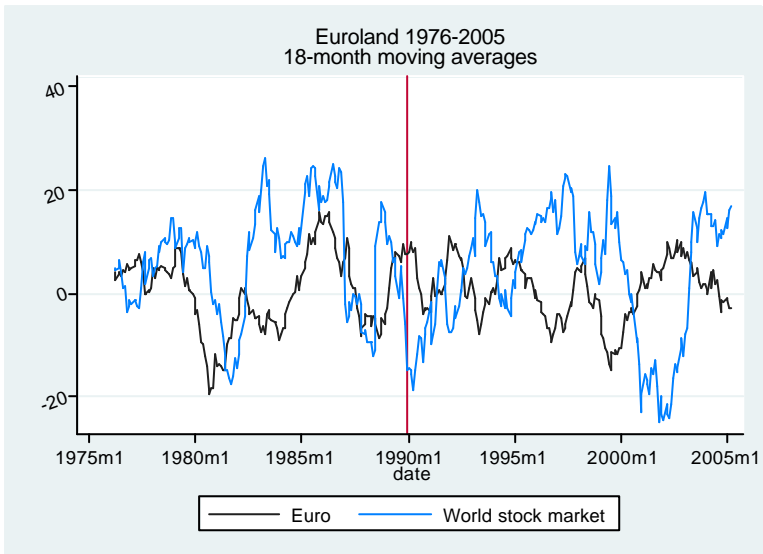


Fig. 4: Currency and hedged world stock market excess returns

Theory of Optimal Currency Demand

Why might pension funds want to hold foreign currency?

- Speculative reasons, if foreign currency has a higher expected return than domestic currency.
- Risk management reasons, if holding foreign currency helps reduce portfolio (or surplus) volatility.

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Speculative Currency Demand

- Forward premium puzzle: Currencies with high short-term interest rates tend to deliver high returns on average.
- Active currency models typically use one version of another of this empirical regularity.
- 017-495-8294 Speculative currency demands are inherently asymmetric: Go long some currencies and simultaneously short others.
- Siegel's paradox (1972): Investors in each country can simultaneously perceive positive expected excess returns on foreign currencies over their own domestic currencies.
 - In practice, small effect (Sharpe ratios about 5%)

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Risk Management Currency Demand (1)

- If there are no domestic assets that help hedge pension liabilities, the portfolio that minimizes surplus volatility may contain foreign currency holdings.
- For example, a pension fund with inflation-indexed liabilities might not have domestic inflation-indexed bonds available to help the fund hedge those liabilities.
- Campbell, Viceira and White (2003) show that portfolios of short-term bonds denominated in euros and dollars can help investors hedge real interest rate risk.
- But today most developed countries have domestic inflation-indexed bonds available for investment.

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Risk Management Currency Demand (2)

- In practice, however, pension funds hold assets other than inflation-indexed bonds, particularly equities.
- Foreign currency positions can diminish portfolio risk if foreign currency returns are correlated with the returns on those assets.
- We explore whether currency returns are correlated with equity returns and bond returns, and determine the optimal currency demands arising from those correlations.

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Our Data

- IMF's IFS database:
 - Exchange rates
 - Nominal interest rates, mostly three-month rates
 - Long-term bond yields.
- MSCI database:
 - Stock returns.
- We report results for seven countries (or regions):
 - Euroland (Germany, France, Italy, and the Netherlands)
 - Australia, Canada, Japan, Switzerland, UK and US.
- Monthly data, 1975:7 – 2005:12.

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Basic Facts

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Table 1
Summary Statistics

	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Interest rates							
$E(i_{c,t})$	6.41	8.51	7.41	3.71	3.21	8.11	5.81
$s(i_{c,t})$	0.81	1.01	1.01	0.91	0.71	0.91	0.81
Hedged stock excess returns							
$E(r_{c,t} - i_{c,t}) + \frac{1}{2}s^2$	7.31	7.21	5.21	4.91	8.41	7.31	7.01
$s(r_{c,t} - i_{c,t})$	16.81	19.51	17.01	18.21	16.41	17.01	14.91
Hedged bond excess returns							
$E(r_{c,t}^b - i_{c,t}) + \frac{1}{2}s^2$	1.01	2.21	2.51	2.91	2.21	2.81	2.71
$s(r_{c,t}^b - i_{c,t})$	3.91	9.51	7.71	7.21	4.81	6.71	7.31
? exchange rate							
$E(?_{S,c,t}) + \frac{1}{2}s^2$	0.71	-1.41	-0.21	3.71	3.11	-0.11	.
$s(?_{S,c,t})$	10.71	10.21	5.41	11.51	12.21	10.71	.
Currency excess returns							
$E(?_{S,c,t} + i_{c,t} - i_{US,t}) + \frac{1}{2}s^2$	1.51	1.31	1.31	1.61	0.61	2.21	.
$s(?_{S,c,t} + i_{c,t} - i_{US,t})$	10.61	10.21	5.41	11.61	12.31	10.81	.

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Table 2
Currency return correlations

	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Base country: Euroland							
Euroland	.	.	.	.	.	.	.
Australia	.	1.00	.	.	.	.	.
Canada	.	0.70	1.00	.	.	.	.
Japan	.	0.35	0.35	1.00	.	.	.
Switzerland	.	-0.09	-0.11	0.20	1.00	.	.
UK	.	0.31	0.34	0.24	-0.02	1.00	.
US	.	0.63	0.87	0.40	-0.07	0.38	1.00
Base country: Australia							
Euroland	1.00	.	.	.	.	.	.
Australia	.	.	.	.	.	.	.
Canada	0.53	.	1.00	.	.	.	.
Japan	0.67	.	0.46	1.00	.	.	.
Switzerland	0.92	.	0.47	0.69	1.00	.	.
UK	0.78	.	0.51	0.59	0.72	1.00	.
US	0.59	.	0.85	0.55	0.54	0.58	1.00

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Table 3
Cross-country return correlations

Stock Markets	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Panel A : Stocks							
Euroland	1.00						
Australia	0.47	1.00					
Canada	0.56	0.58	1.00				
Japan	0.46	0.32	0.36	1.00			
Switzerland	0.75	0.44	0.53	0.41	1.00		
UK	0.66	0.50	0.55	0.37	0.61	1.00	
US	0.66	0.51	0.73	0.37	0.63	0.63	1.00

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Table 3
Cross-country return correlations

	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Panel B : Bonds							
Euroland	1.00						
Australia	0.32	1.00					
Canada	0.41	0.27	1.00				
Japan	0.32	0.17	0.31	1.00			
Switzerland	0.50	0.23	0.29	0.30	1.00		
UK	0.44	0.18	0.33	0.18	0.28	1.00	
US	0.55	0.24	0.62	0.32	0.37	0.37	1.00

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Single-Country Stock Portfolios

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Table 4
Optimal currency exposure for single-country stock portfolios: single and multiple currency cases

Stock market	Currency						
	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Panel A	Single currency						
→ Euroland		-0.43* (0.11)	-0.57* (0.14)	-0.32* (0.09)	0.37 (0.20)	-0.37* (0.12)	-0.52* (0.14)
→ Australia	0.39* (0.12)		0.13 (0.13)	0.18 (0.11)	0.32* (0.11)	0.16 (0.14)	0.29* (0.12)
→ Canada	0.42* (0.11)	-0.02 (0.12)		0.13 (0.10)	0.35* (0.10)	0.14 (0.12)	0.96* (0.22)
Japan	0.34* (0.12)	-0.09 (0.11)	-0.06 (0.12)		0.36* (0.12)	0.17 (0.10)	0.04 (0.13)
→ Switzerland	-0.51* (0.17)	-0.37* (0.08)	-0.44* (0.10)	-0.27* (0.09)		-0.32* (0.09)	-0.43* (0.11)
UK	0.26 (0.13)	-0.26* (0.11)	-0.32* (0.13)	-0.10 (0.08)	0.26* (0.10)		-0.24 (0.13)
→ US	0.19 (0.11)	-0.14 (0.09)	-0.77* (0.17)	-0.03 (0.10)	0.19* (0.09)	0.09 (0.11)	

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Equal-Weighted Global Stock Portfolio

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Reserve currencies

Optimal currency exposure for an equally-weighted global equity portfolio: multiple-currency case

Time horizon	Currency						
	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Panel A	7 country optimization						
1 month	0.17 (0.15)	-0.16 (0.11)	-0.61* (0.14)	-0.11 (0.07)	0.23 (0.12)	-0.11 (0.08)	0.60* (0.15)
2 months	0.29 (0.15)	-0.13 (0.09)	-0.63* (0.15)	-0.19* (0.07)	0.26 (0.13)	-0.11 (0.09)	0.51* (0.15)
3 months	0.32 (0.17)	-0.11 (0.09)	-0.61* (0.16)	-0.17 (0.09)	0.27 (0.15)	-0.10 (0.11)	0.40* (0.18)
6 months	0.20 (0.26)	-0.05 (0.14)	-0.38 (0.25)	-0.25* (0.12)	0.35 (0.20)	-0.06 (0.16)	0.19 (0.28)
12 months	-0.20 (0.40)	0.21 (0.20)	-0.22 (0.36)	-0.41* (0.17)	0.67* (0.30)	-0.20 (0.21)	0.15 (0.37)

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Table 5
Optimal currency exposure for an equally-weighted global equity portfolio: multiple-currency case

Time horizon	Currency						
	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Panel B: 5 country optimization							
1 month	0.37* (0.11)	-0.29* (0.11)		-0.08 (0.07)		-0.10 (0.08)	0.11 (0.08)
2 months	0.50* (0.11)	-0.27* (0.09)		-0.15* (0.07)		-0.09 (0.09)	0.01 (0.11)
3 months	0.56* (0.11)	-0.27* (0.10)		-0.14 (0.08)		-0.09 (0.11)	-0.06 (0.14)
6 months	0.53* (0.14)	-0.21 (0.13)		-0.21* (0.10)		-0.02 (0.15)	-0.09 (0.18)
12 months	0.44* (0.19)	0.05 (0.17)		-0.34* (0.15)		-0.16 (0.19)	0.01 (0.22)

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Single-Country Bond Portfolios

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Table 9
Optimal currency exposure for single-country bond portfolios: single and multiple currency cases

Bond market	Currency						
	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Panel A : Single currency							
Euroland		0.04 (0.03)	0.05 (0.03)	-0.03 (0.04)	-0.02 (0.06)	0.09* (0.04)	0.06 (0.04)
Australia	-0.02 (0.05)		0.04 (0.07)	0.00 (0.05)	-0.01 (0.05)	0.02 (0.04)	0.06 (0.05)
Canada	-0.07 (0.05)	0.12* (0.05)		-0.07 (0.05)	-0.08 (0.04)	-0.07 (0.06)	0.24* (0.08)
Japan	0.05 (0.05)	0.09* (0.04)	0.14* (0.05)		0.01 (0.05)	0.10* (0.05)	0.16* (0.05)
Switzerland	0.08 (0.07)	0.02 (0.02)	0.05 (0.03)	-0.02 (0.04)		0.09* (0.04)	0.05 (0.03)
UK	0.22* (0.05)	0.07* (0.04)	0.11* (0.05)	0.02 (0.04)	0.13* (0.05)		0.12* (0.04)
US	-0.21* (0.05)	0.03 (0.05)	-0.21* (0.09)	-0.15* (0.05)	-0.18* (0.04)	-0.09 (0.05)	

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How Much Is Risk Reduced?

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Table 7
Variance Reduction: standard deviations of hedged portfolios

Base country	No hedge	Half hedge	Full hedge	Optimal hedge
Equally-weighted portfolio				
Euroland	16.99	15.20	13.86	12.51
Australia	14.41	13.45	13.86	12.51
Canada	13.48	13.24	13.86	12.51
Japan	16.26	14.44	13.86	12.51
Switzerland	18.24	15.71	13.86	12.51
UK	16.10	14.54	13.86	12.51
US	14.63	13.83	13.86	12.51

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How Much is Risk Reduced?

- Currency hedging means holding your base currency.
- This reduces risk much more for equity investors (e.g. Euroland or Swiss investors) whose base currency is a reserve currency, than for equity investors (e.g. Australian investors) whose base currency is a normal currency.
- The optimal hedge (long reserve currencies, short normal currencies) is advantageous for all equity investors.
- Bond investors do not achieve significant reductions in risk from using the optimal hedge.

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Have Things Changed Over Time?

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Table 8
Subperiod analysis
Equally-weighted global equity portfolio: multiple-currency case

Time horizon	Currency						
	Euroland	Australia	Canada	Japan	Switzerland	UK	US
Panel A : 7 country optimization							
Subperiod I : 1975-1989							
1 month	0.15 (0.20)	-0.11 (0.16)	-0.73* (0.23)	-0.06 (0.12)	0.08 (0.13)	-0.06 (0.11)	0.73* (0.24)
3 months	0.14 (0.21)	-0.05 (0.12)	-0.63* (0.26)	-0.20 (0.14)	0.22 (0.18)	-0.09 (0.15)	0.62 (0.35)
12 months	-0.62 (0.45)	0.23 (0.22)	-0.15 (0.61)	-0.31 (0.23)	0.57 (0.33)	-0.04 (0.23)	0.33 (0.61)
Subperiod II : 1990-2005							
1 month	0.10 (0.27)	-0.25* (0.12)	-0.49* (0.18)	-0.15 (0.09)	0.51* (0.23)	-0.20 (0.13)	0.48* (0.18)
3 months	0.44 (0.28)	-0.17 (0.14)	-0.65* (0.21)	-0.08 (0.10)	0.37 (0.23)	-0.12 (0.14)	0.22 (0.19)
12 months	0.56 (0.52)	-0.17 (0.29)	-0.31 (0.37)	-0.23 (0.23)	0.47 (0.49)	-0.22 (0.25)	-0.11 (0.37)

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Have Things Changed Over Time?

- In the 1990's the euro started to move against world equity markets, making it a reserve currency.
- The Swiss franc moves with the euro, so it also became a reserve currency.
- The dollar appears to have weakened slightly.

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Minimizing Surplus Risk

- Work in progress, joint with Roy Hoevenaars, Roderick Molenaar, and Tom Steenkamp from ABP.
- So far I have shown currency demands that help minimize the volatility of long-only portfolios.
- Pension funds may be interested in the currency demands that minimize surplus risk.

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Minimizing Surplus Risk

- Preliminary results: Currency demands that minimize surplus risk of funds with nominal liabilities are similar to those of equivalent long only portfolios.
- If the fund holds equities, surplus risk is minimized by going long reserve currencies and short normal currencies.
- If the fund holds bonds, surplus risk is minimized by fully hedging currency exposures.

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Open Questions

- Will covariances change, for example if global investors lose faith in the US dollar?
- Are currencies priced so that normal currencies offer higher average returns than reserve currencies?
 - There is some evidence that they do.
 - The difference in return works to offset the risk management currency demands that we have identified.

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