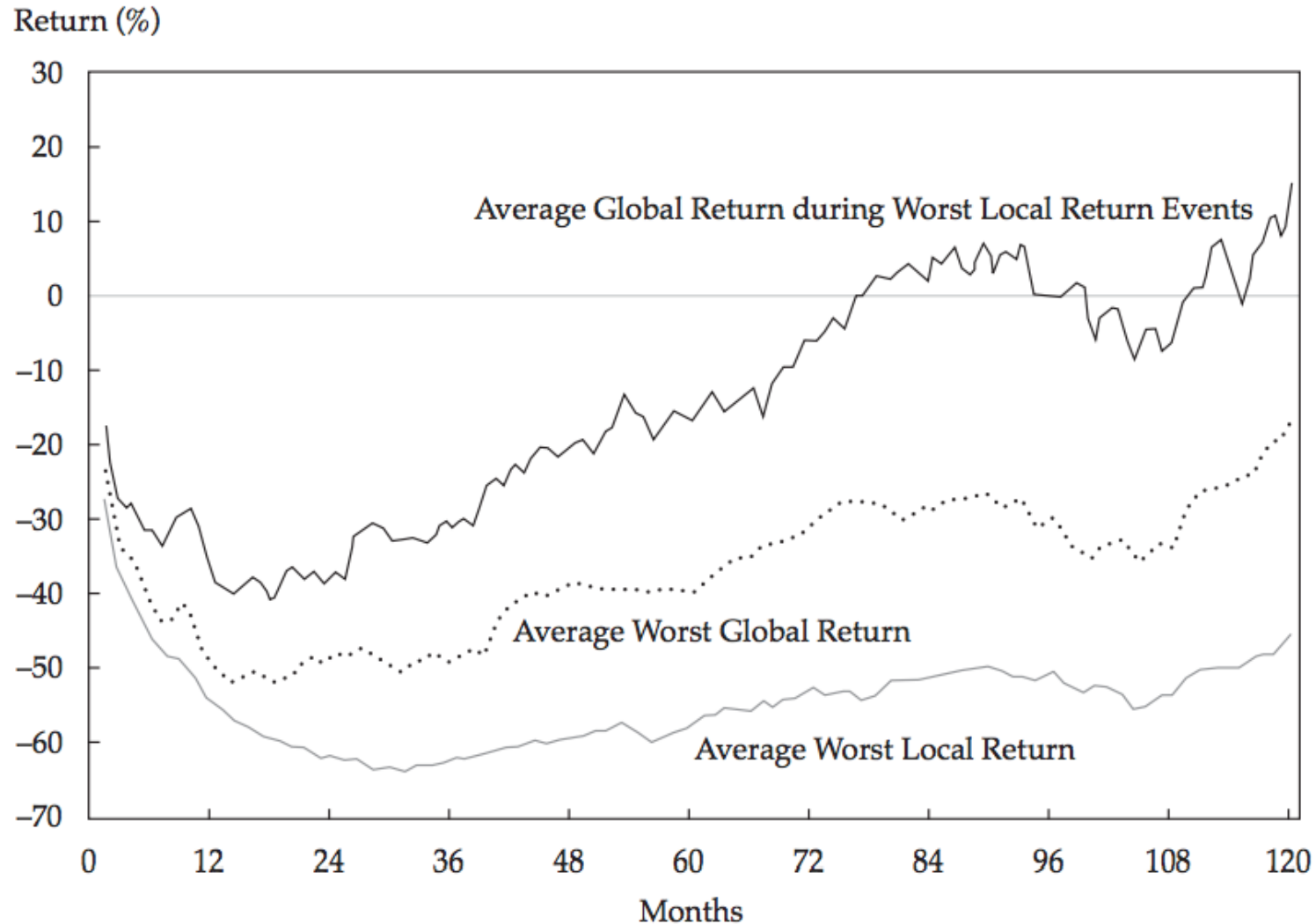


Lecture 12 : International Investing with Currency Risk and Return



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Long-term performance of intl. diversification



International investing

- We know that adding assets to a portfolio can reduce variance
 - The CAPM market portfolio included all available assets
- Only question: how much to weight the assets?
 - In equilibrium, market weights are informative
 - Apply this logic to international markets



	Market Capitalization									GDP 2009 (\$ bil)	GDP per Capita 2009	Market Capitalization as Percent of GDP 2009
	Billions of U.S. Dollars						Percent of World		Growth (%)			
	2004	2005	2006	2007	2008	2009	2004	2009	2004–2009			
World	31,701	35,525	43,104	48,333	26,786	37,193	100%	100%	17.3%	57,530	10,348	65%
United States	13,345	13,934	15,606	15,921	9,568	12,299	42.1	33.1	–7.8	14,270	46,450	86
Japan	3,486	4,420	4,505	4,280	3,087	3,273	11.0	8.8	–6.1	5,049	39,731	65
United Kingdom	2,730	2,975	3,692	3,723	1,837	2,760	8.6	7.4	1.1	2,198	35,966	126
France	1,436	1,667	2,313	2,572	1,408	1,828	4.5	4.9	27.3	2,635	41,135	69
Canada	960	1,206	1,399	1,669	893	1,431	3.0	3.8	49.1	1,319	39,388	108
Hong Kong	706	778	1,120	1,669	853	1,351	2.2	3.6	91.4	209	29,596	647
Germany	1,117	1,219	1,599	2,020	1,089	1,266	3.5	3.4	13.3	3,235	39,293	39
Australia	641	721	933	1,188	597	1,102	2.0	3.0	71.9	920	43,268	120
Switzerland	812	921	1,193	1,251	850	1,049	2.6	2.8	29.2	484	63,660	217
Spain	635	651	926	1,017	649	773	2.0	2.1	21.8	1,438	35,484	54
Italy	778	786	1,020	1,070	524	663	2.5	1.8	–14.8	2,090	35,956	32
South Korea	356	549	655	865	390	647	1.1	1.7	82.0	800	16,498	81
Netherlands	612	543	725	777	304	459	1.9	1.2	–24.9	790	47,242	58
Sweden	343	366	510	499	235	398	1.1	1.1	15.9	398	43,898	100
Singapore	154	183	314	412	222	396	0.5	1.1	157.4	163	35,018	243
Belgium	269	270	335	359	156	248	0.8	0.7	–7.9	462	44,314	54
Norway	137	193	267	340	123	230	0.4	0.6	67.6	369	79,175	62
Finland	174	198	252	341	148	180	0.5	0.5	3.6	242	46,150	74
Denmark	143	163	201	231	115	162	0.5	0.4	13.7	308	56,049	53
Israel	67	85	109	156	87	148	0.2	0.4	121.3	216	29,819	69
Austria	87	133	173	203	76	117	0.3	0.3	34.4	374	45,601	31
Greece	105	124	174	228	80	101	0.3	0.3	–3.5	338	31,507	30
Portugal	74	71	106	136	65	93	0.2	0.2	25.3	220	20,527	42
Ireland	106	111	157	136	45	64	0.3	0.2	–39.8	227	53,959	28
New Zealand	40	39	41	44	22	33	0.1	0.1	–18.4	110	26,012	30
Rest of the world	2,388	3,220	4,780	7,225	3,362	6,121	7.5	16.5	156.3	18,667		

Table 25.1

Market capitalization of stock exchanges in developed countries

Sources: Market capitalization, Datastream; GDP and per capita GDP, www.cia.gov/library/publications/the-world-factbook/index.html.



	Market Capitalization									GDP 2009 (\$ bil)	GDP per Capita 2009	Market Capitalization as Percent of GDP 2009
	Billions of U.S. Dollars						Percent of World		Growth (%)			
	2004	2005	2006	2007	2008	2009	2004	2009	2004-2009			
Total emerging markets	2,230	2,934	4,654	6,952	3,285	6,022	7.0%	16.2%	170.0%	13,691		44%
Brazil	323	407	604	1,136	520	1,150	1.0	3.1	255.8	1,482	7,457	78
India	301	408	605	1,285	499	992	0.9	2.7	229.9	1,243	1,074	80
Russia	132	224	778	1,072	324	686	0.4	1.8	419.7	1,255	8,962	55
China	59	163	421	637	345	572	0.2	1.5	874.4	4,758	3,554	12
Taiwan	332	351	437	488	271	464	1.0	1.2	39.8	357	15,552	130
South Africa	225	284	333	394	225	365	0.7	1.0	62.4	277	5,655	132
Mexico	171	238	346	356	212	313	0.5	0.8	83.8	866	7,790	36
Malaysia	137	142	183	249	151	230	0.4	0.6	67.4	207	8,065	111
Turkey	83	128	135	241	106	198	0.3	0.5	140.0	594	7,727	33
Chile	94	111	145	180	113	196	0.3	0.5	109.7	150	9,059	131
Indonesia	64	70	120	178	82	184	0.2	0.5	187.8	515	2,143	36
Thailand	86	97	107	154	81	143	0.3	0.4	67.0	266	4,036	54
Colombia	20	42	42	54	82	135	0.1	0.4	569.4	229	5,234	59
Poland	63	77	125	169	77	109	0.2	0.3	72.6	423	10,992	26
Philippines	26	41	60	91	45	76	0.1	0.2	193.7	159	1,620	48
Peru	15	19	55	60	40	65	0.0	0.2	339.3	127	4,312	51
Czech Republic	30	38	50	77	44	46	0.1	0.1	53.4	190	18,576	24
Argentina	21	24	30	36	36	41	0.1	0.1	98.2	301	7,364	14
Hungary	28	33	42	46	19	30	0.1	0.1	6.7	124	12,538	24
Pakistan	21	36	37	49	16	25	0.1	0.1	16.0	167	954	15

Table 25.2

Market capitalization of stock exchanges in emerging markets

Sources: Market capitalization, Datastream; GDP and per capita GDP, www.cia.gov/library/publications/the-world-factbook/index.html.



TABLE 1—EQUITY PORTFOLIO WEIGHTS:
BRITISH, JAPANESE, U.S. INVESTORS

	Portfolio Weight			Adj. Market Value
	U.S.	Japan	U.K.	
U.S.	.938	.0131	.059	\$2941.3
Japan	.031	.9811	.048	1632.9
U.K.	.011	.0019	.820	849.8
France	.005	.0013	.032	265.4
Germany	.005	.0013	.035	235.8
Canada	.010	.0012	.006	233.5

Note: Estimates correspond to portfolio holdings in December, 1989. They are based on the authors' tabulations using data from the *U.S. Treasury Bulletin* and Michael Howell and Angela Cozzini (1990). Adjusted



Home bias

- True in more recent data too
- U.S. investors held 78% of their equity portfolio in U.S. stocks
- Canadian investors held 76% in Canadian Stocks
- German investors held 51% in German Stocks
- UK investors held 61% in U.K. stocks
- Improvement, but still lots of room for growth



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Is the international “market portfolio” sensible?

- There are reasons why to not hold the “market”
- In many jurisdictions, taxes and other regulations favor local investors over foreign
 - This will distort equilibrium market weights
- CAPM also assumes all investors face identical expected returns and covariances
 - What about exchange rate volatility? Inflation?
 - If we consume in local currency, investors in different countries may face different optimization problems



Impact of FX and Returns

- Consider the impact of exchange rate movement on dollar denominated stock returns

Domestic Currency Returns
(1999-2010)

	Australia	France	Germany	Hong Kong	Japan	UK	US
Avg Return	5.24%	0.71%	3.75%	10.31%	-1.11%	-0.05%	-0.31%
Standard deviation	13.33%	19.23%	24.01%	24.59%	20.17%	14.81%	15.90%

USD Returns (1999-2010)

	Australia	France	Germany	Hong Kong	Japan	UK	US
Avg Return	9.99%	3.03%	6.19%	10.30%	0.87%	0.09%	-0.31%
Standard deviation	19.49%	21.12%	25.78%	24.66%	20.35%	16.81%	15.90%

- Foreign currency appreciation(USD depreciation) has bolstered foreign returns over this decade

Hedging Exchange Rate Risk

- Hedging exchange rate risk is straightforward given a currency futures market when returns are riskless
 - More difficult when returns are risky
- To do so, we need to understand the basics of futures/forward contracts

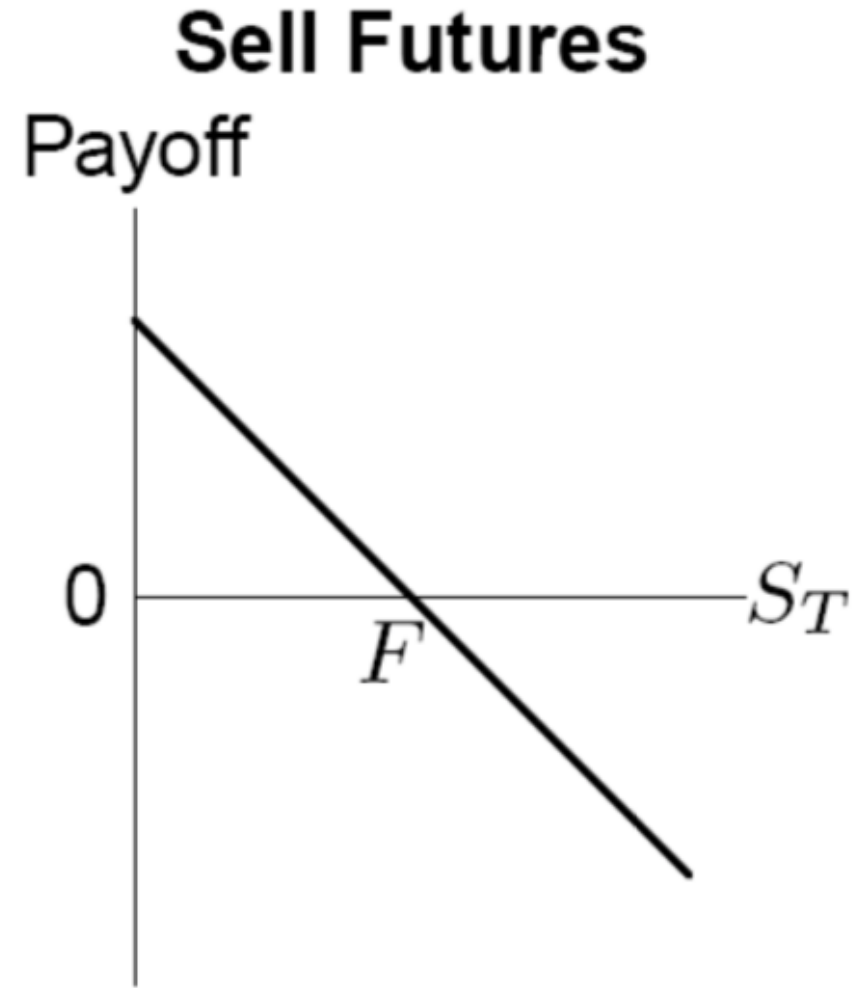
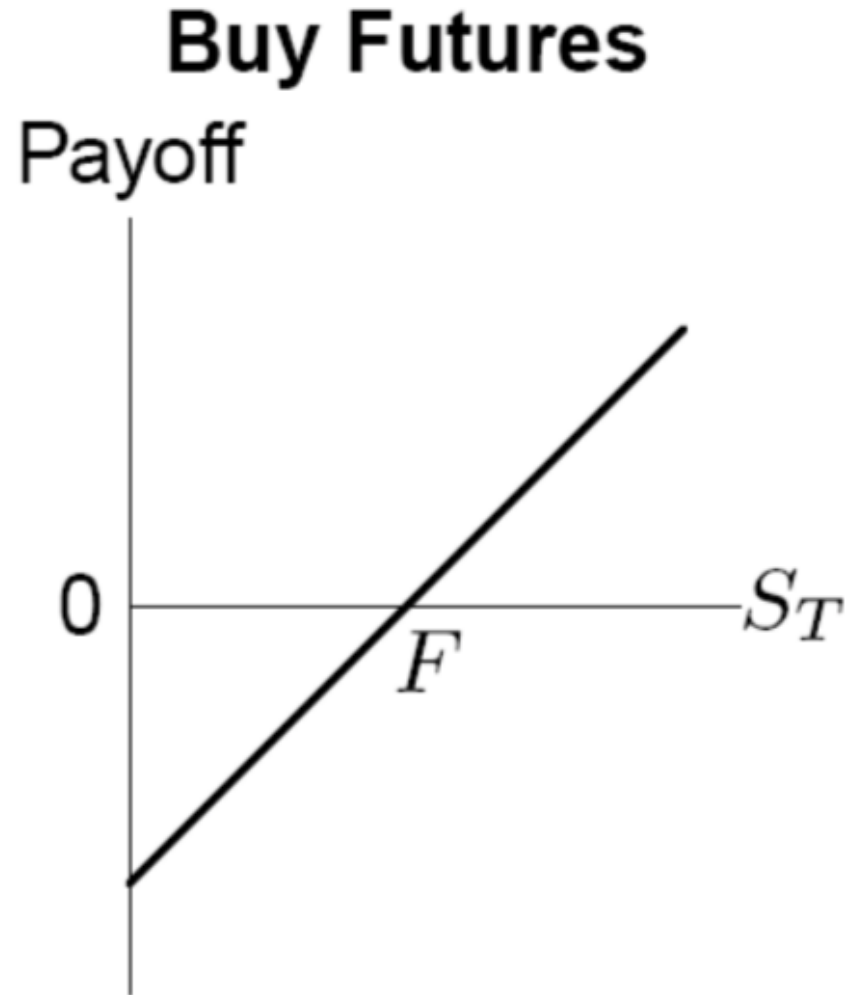


Forwards and Futures

- A forward contract is a commitment to purchase/sell at a future date a given amount of an asset at a price agreed upon today
 - Currencies, commodities, equities/indices, rates
- F_0 is the forward price and represents the fixed price (agreed at $t=0$) for a future exchange
- S_0 represents the spot price prevailing today, S_T represents spot price at future date T
- Note: both parties bound to contract; no option value



Forwards and Futures Payoff



Forwards and Futures Payoff

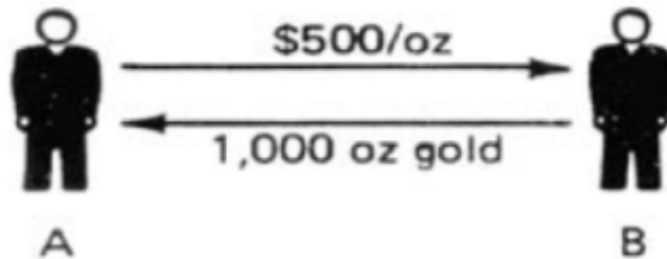
- To buy a future/forward contract is to be long on the asset
 - Obligation to buy
 - Payoff is $S_T - F_0$
- To sell a future/forward contract is to be short on the asset
 - Obligation to sell
 - Payoff is $F_0 - S_T$
- Key differences between forwards and futures...



Forward Transaction

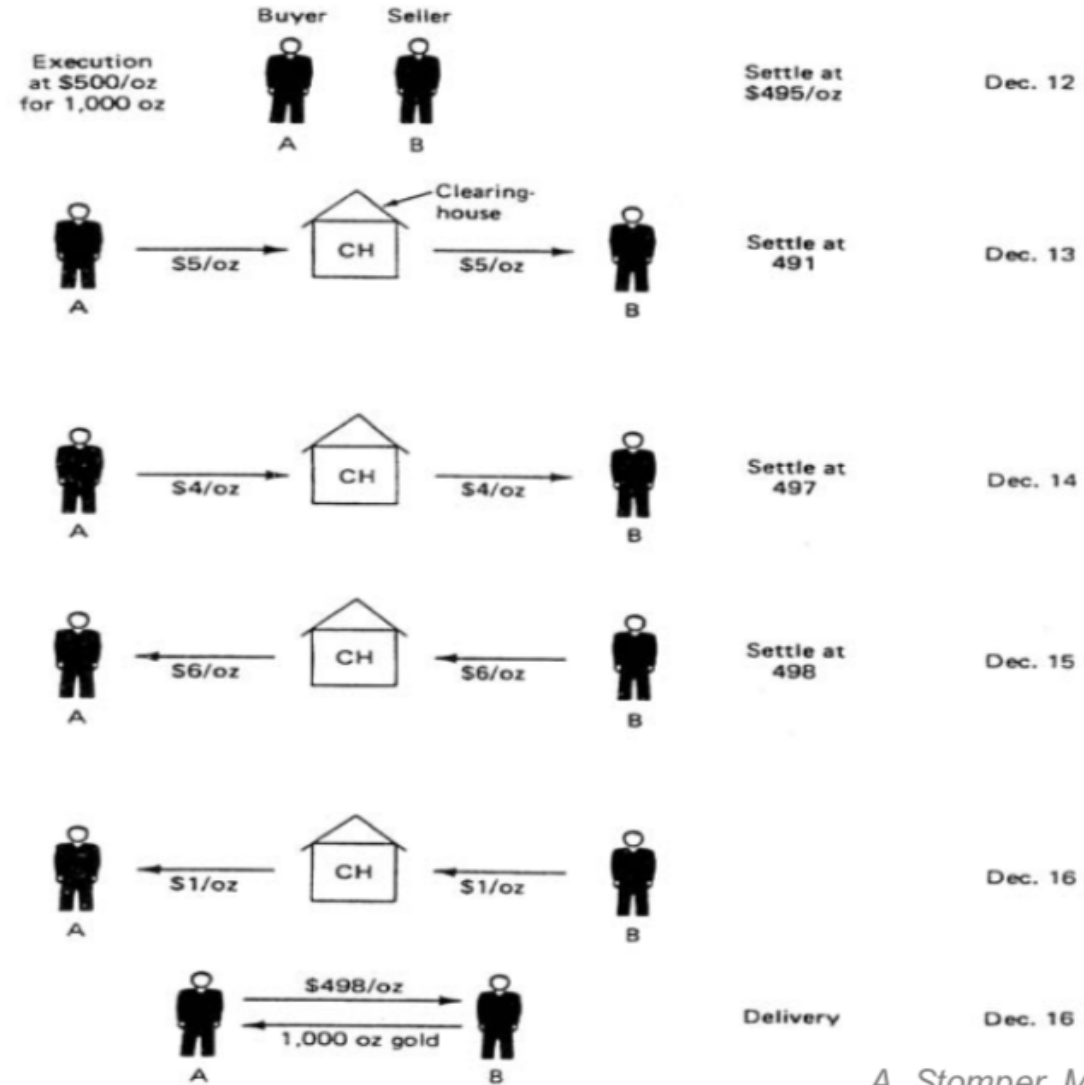


December 12



December 15

Future Transaction



A. Stomper, MIT, 2012



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Pricing FX Forwards/Futures

- Consider the following strategy
 - Buy 1 Australian Dollar at S_0 (USD/AUS), financed at $(1 + r_{us})$
 - Invest in risk-free Australian Bond at $(1 + r_{AUS})^T$
 - Sell $(1 + r_{AUS})^T$ futures contract at futures price F_0 (USD/AUS)

Action	Initial cash flow	End of period cash flow
Borrow S_0	S_0	$-S_0(1+r_{US})^T$
Buy 1 AUD, invest in bonds	$-S_0$	$S_T(1+r_{AUS})^T$
Enter short futures position		$(1+r_{AUS})^T(F_0-S_T)$
TOTAL	0	$F_0(1+r_{AUS})^T - S_0(1+r_{US})^T$



FX Forwards

- This implies

$$F_{0,T} = S_0 \left(\frac{1 + r_{local}}{1 + r_{foreign}} \right)^T,$$

where the spot price is quoted in local currency per unit of foreign currency

- This relationship is called “covered interest rate parity”
 - Says a hedged investment in risk free foreign bonds only earns the local risk free return
 - Should hold exactly by no arbitrage
- Question: What happens if you don’t hedge?



The Carry Trade

- The carry trade borrows in low interest rate currencies and lends in high interest rate currencies
- Profitable if either
 1. exchange rates remain unchanged
 2. high interest rate currency appreciates
- Alternatively, instead of borrowing and lending, use the futures market
- Buying futures contracts is equivalent to borrowing S_0 locally and lending in the foreign market
 - you can verify this by examining the cash flows from the hedged borrowing/lending strategy
- Higher foreign interest rates implies $F_0 < S_0$ (forward discount)
- As long as exchange rates are unchanged, this is profitable

The Carry Trade

- Another parity theorem predicts that this won't work
- Uncovered interest rate parity suggests

$$E(S_T) = S_0 \left(\frac{1 + r_{local}}{1 + r_{foreign}} \right)^T = F_0$$

- The theorem says investors will only buy low (high) interest rates currencies if they expect them to appreciate (depreciate)
- **Covered interest rate parity** says the riskless (hedged) trade is unprofitable
- **Uncovered interest rate parity** says even the risky (unhedged) trade is unprofitable



The Carry Trade

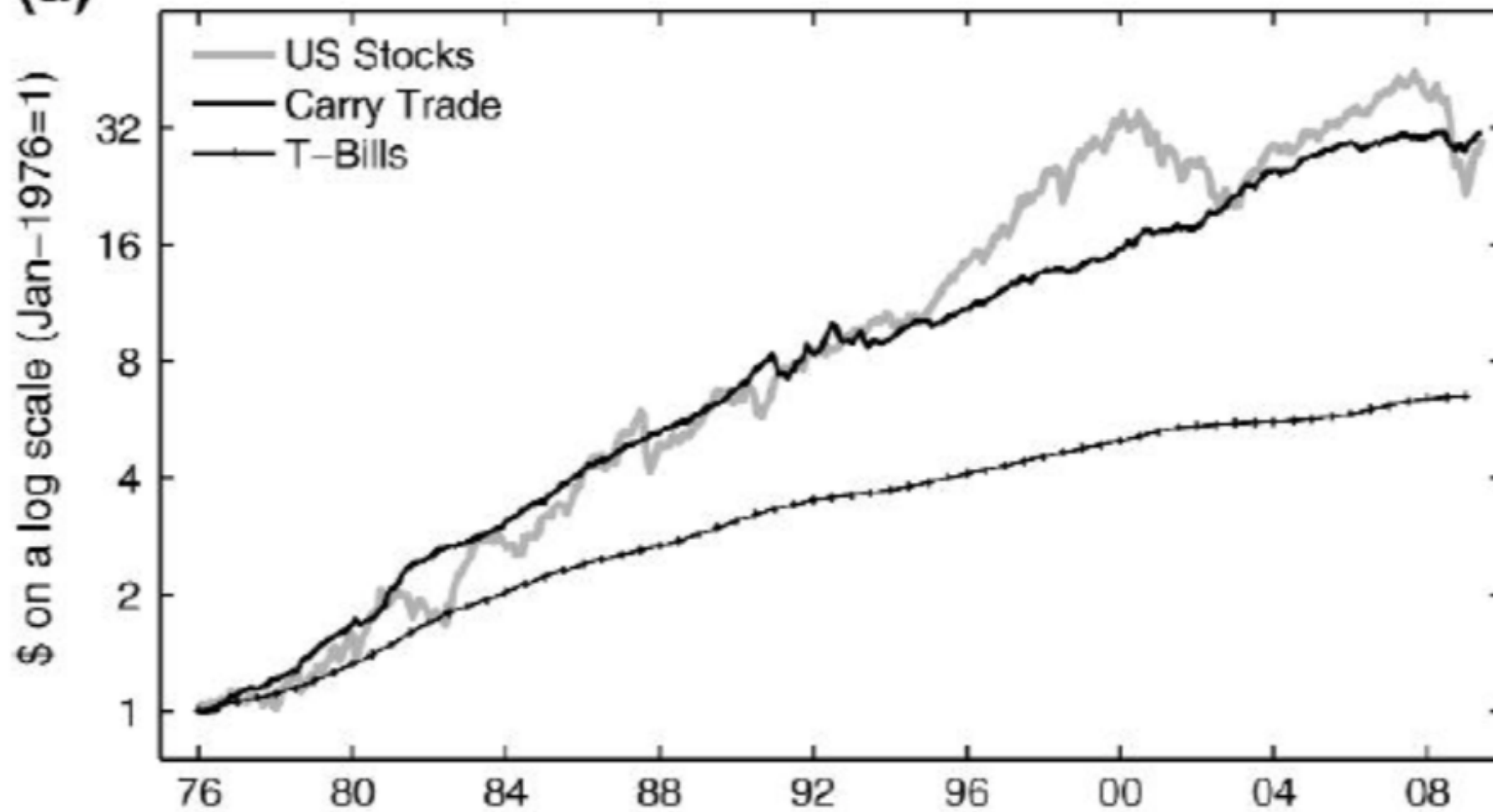
- Theoretical implications of uncovered interest rate parity
 1. Futures price equals expected spot price
 2. Interest rate differentials offset by expected changes in spot price

$$(1 + r_{us}) = (1 + r_{foreign})(1 + r_{FX})$$

- These suggest the carry trade should only break even on average



(a)



The Carry Trade

- UIP predicts low interest rate currency will appreciate relative to high
- Consistently, this result fails to deliver – Instead, low interest rate currencies typically depreciate as traders borrow (short) these currencies to lend (buy) in high yielding currencies
- Carry trade profits from interest rate spread and currency appreciation



The Carry Trade

- UIP relies on risk neutrality - risk aversion may help explain carry returns
- Burnside (2011) finds low market loadings, high alpha from a CAPM regression
- Menhoffs, Sarno, Schmeling, and Schrimpf (2011) suggest carry trade does poorly in currency crises
- Still largely unexplained – tied to many extreme “tail” events. Unwinding during currency crises, financial crisis, etc.



Review Problems

1. What are the two types of risk embedded in a return? How would you measure these in a CAPM regression?
2. What is the capital allocation line? What feature of it do you want to maximize?
3. What are the types of ways of evaluating an investment or investment manager? What scenarios are these most appropriate?
4. Draw the security market line. Under the CAPM, where should stocks lie?
5. You've described the CAPM model to a friend and they looked up evidence showing how it fails. Describe some of the reasons why the CAPM might not hold. What are reasons it might still be useful?
6. You are a graduate of Yale SOM, with a relatively high-paying and secure (i.e. low risk) job in the near-future. How should your investment strategy compare someone with a future job profile that is higher risk? Explain why.
7. Explain why an investor can't just use Markowitz portfolio optimization for finding the optimal portfolio of risky assets. What are some solutions?
8. List what you think are the main benefits of financial investment. Which of these can an institutional investor achieve? Which can an individual investor?

