Currency Momentum Strategies

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  - hard to explain with standard models of risk
  - seemingly driven by "investor irrationality" (underreaction and overreaction) and limits to arbitrage
- We study momentum in foreign exchange (FX) markets which are very liquid, have no short-selling constraints, and are populated by professional investors.

Earlier literature

- Huge and exhaustive list on momentum returns in stock markets (e.g. Jegadeesh/Titman, 1993, 2001, Chan et al., 1996, Rouwenhorst, 1998, Chordia/Shivakumar, 2002, Johnson, 2002, Griffin/Martin, 2003, Lesmond et al., 2004, Avramov et al., 2007, Chui et al., 2010).
- However, still unclear whether momentum returns are actually exploitable (transaction costs, limits to arbitrage) and whether they stem from risk (e.g. Chordia/Shivakumar, 2002, Johnson, 2002, Pastor/Stambaugh, 2003) or investor irrationality (e.g. Chui et al. 2010).

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- Surprisingly few studies for currency markets.
- Okunev and White (2003) study eight currencies from 1980 to 2000 and find positive momentum returns. Asness et al. (2009) report similar findings and Burnside et al. (2011) show, among other things, that standard risk factors cannot account for currency momentum.

Our contribution

We perform a comprehensive study of momentum in currency excess returns (and spot rate changes):

- Broad cross-section of 48 countries (developed and emerging markets)
- Sample from 1976 – 2010.
- We are able to control for transaction costs for the full sample period and all currencies.

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Currency momentum is more or less unrelated to the carry trade.

We can rationalize these returns through a combination of transaction costs and limits-to-arbitrage arguments.

Agenda

1. **Data, currency returns, and momentum portfolios**
2. Currency momentum versus carry trades
3. Sources of momentum profits
4. Understanding momentum returns

Data

- We use data on forward rates (f) and spot rates (s) from BBI and Reuters (via Datastream). Complement this with Reuters data quoted against the Sterling.
- Total sample consists of 48 countries. Countries
- Bid and ask quotes for spot and forward rates.
- Sample period: 01/1976 – 01/2010 (monthly).

A. Currency excess returns

- We calculate excess returns for a US investor.
- USD excess return to investing in foreign currency k:

$$rx_{t+1}^k = i_t^k - i_t^{US} - \triangle s_{t+1}^k$$

$-\triangle s_{t+1}^k \simeq$ % appreciation of foreign currency against the USD

- Since the (log) forward discount $f_t^k - s_t^k$ equals $i_t^k - i_t^{US}$ (CIP):

$$rx_{t+1}^k = f_t^k - s_{t+1}^k$$

A. Currency excess returns

Transaction costs

- Long position (sell USD forward in t, buy spot USD in $t+1$):

$$rx^{l}_{t+1} = f^{b}_{t} - s^{a}_{t+1}$$

- Short position (buy USD forward in t, sell spot USD in $t+1$):

$$rx^{s}_{t+1} = -f^{a}_{t} + s^{b}_{t+1}$$

B. Currency momentum portfolios: Construction

- Sort currencies into six portfolios based on lagged excess returns over f months:
  - Portfolio 1: 1/6 of all currencies with lowest lagged excess returns
  - ...
  - Portfolio 6: 1/6 of all currencies with highest lagged excess returns

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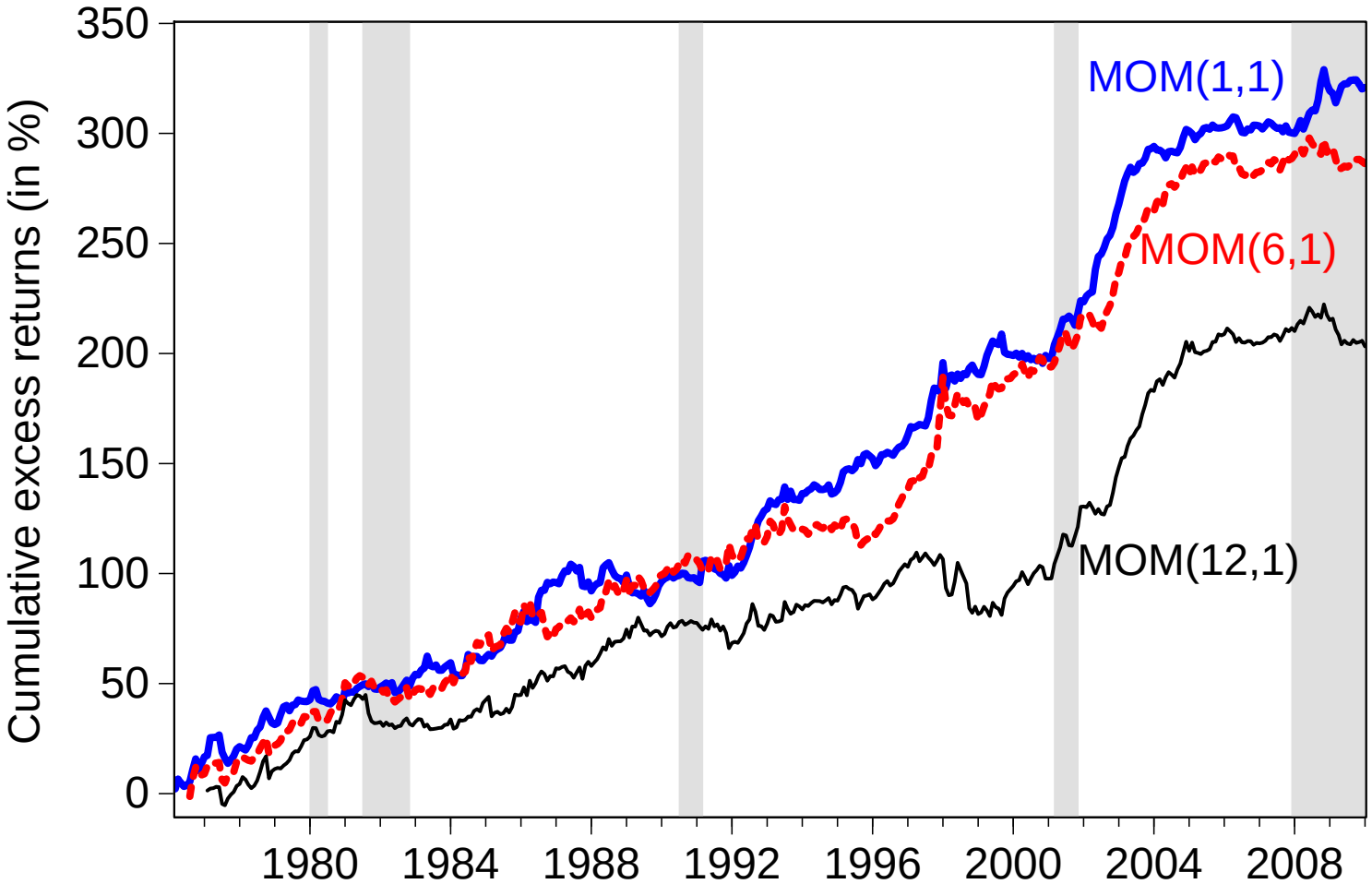
- Hold these portfolios for h months, then rebalance.
- PF 6 minus PF 1: "Long-short momentum portfolio"
- We do the same analyses for spot rate changes instead of excess returns as well.

C. Currency momentum portfolios: Excess returns

	Excess returns (without b/a)				
	Holding period h				
f	1	3	6	9	12
1	9.46	7.00	6.17	5.15	5.75
	[5.31]	[4.11]	[3.13]	[2.73]	[3.16]
3	9.40	6.32	4.96	4.67	4.43
	[5.30]	[3.80]	[3.03]	[2.92]	[2.74]
6	8.54	6.31	3.66	3.25	3.14
	[4.78]	[3.63]	[2.06]	[1.79]	[1.69]
9	7.18	6.80	5.36	3.86	3.24
	[3.80]	[3.65]	[2.86]	[2.05]	[1.67]
12	6.16	5.48	3.02	2.05	1.89
	[3.40]	[3.24]	[1.75]	[1.17]	[1.04]

C. Currency momentum portfolios: Cumulative returns



C. Currency momentum portfolios: Spot rate changes

	Spot rate changes (without b/a)				
	Holding period h				
f	1	3	6	9	12
1	7.91	4.42	3.38	4.75	3.13
	[4.55]	[3.07]	[1.93]	[2.94]	[2.02]
3	8.54	5.73	5.28	4.63	5.10
	[5.10]	[3.59]	[3.66]	[2.88]	[3.51]
6	6.50	5.75	3.47	3.64	3.17
	[3.88]	[4.00]	[2.15]	[2.32]	[1.80]
9	8.33	7.06	6.50	4.91	4.09
	[4.82]	[4.23]	[3.91]	[2.87]	[2.35]
12	7.59	6.04	3.94	3.19	3.03
	[4.63]	[4.02]	[2.59]	[1.97]	[1.92]

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Comparing currency momentum and carry trades

The dominant factor in exchange rate returns seems to be the carry trade (Lustig/Verdelhan, 2007, Lustig at al., 2010):

- Buy high interest rate currencies
- Sell low interest rate currencies

Common assertion seems to be that currency momentum and carry trades are the same, since sorting on lagged excess returns should be similar to sorting on lagged interest rate differentials.

Hence, we first investigate whether the two strategies are related or not.

A. Portfolio characteristics

	Panel A: Momentum Portfolios ($f = 1$, $h = 1$)							
	Low	2	3	4	5	High	Av.	H–L
Mean	-4.17	-0.87	0.27	2.25	2.08	5.34	0.81	9.51
	[-2.36]	[-0.49]	[0.16]	[1.31]	[1.25]	[2.94]	[0.53]	[5.26]
Stand. Dev.	2.88	2.57	2.61	2.57	2.64	2.64	2.28	2.87
Skewness	-0.27	-0.79	-0.32	-0.26	-0.58	-0.29	-0.42	0.06
$\overline{rx}_{-1}$	-2.93	-1.03	-0.23	0.42	1.21	2.94		
$\overline{(f-s)}_{-1}$	0.44	0.75	1.17	1.34	1.93	5.13		

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$\overline{rx}_{-1}$	-2.93	-1.03	-0.23	0.42	1.21	2.94		
$\overline{(f-s)}_{-1}$	0.44	0.75	1.17	1.34	1.93	5.13		

	Panel B: Carry Trade Portfolios							
	Low	2	3	4	5	High	Av.	H–L
Mean	-3.39	-1.41	0.24	1.32	2.04	6.77	0.93	10.15
	[-1.94]	[-0.93]	[0.15]	[0.81]	[1.17]	[3.22]	[0.61]	[5.79]
Stand. Dev.	2.71	2.39	2.39	2.49	2.64	2.98	2.28	2.64
Skewness	-0.21	-0.42	-0.28	-0.37	-0.75	-0.35	-0.37	-0.69
$\overline{rx}_{-1}$	-0.32	-0.11	0.01	0.13	0.23	0.52		
$\overline{(f-s)}_{-1}$	-4.81	-1.79	0.02	1.59	4.02	11.65		

B. Return correlations

	Momentum and carry trade portfolios						
	Low	2	3	4	5	High	H–L
$\rho(MOM_{1,1}, C)$	0.68	0.84	0.83	0.85	0.81	0.73	0.04
$\rho(MOM_{6,1}, C)$	0.63	0.84	0.82	0.83	0.81	0.74	0.01
$\rho(MOM_{12,1}, C)$	0.67	0.85	0.81	0.87	0.82	0.74	0.07

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	Low	2	3	4	5	High	H–L
$\rho(MOM_{1,1}, C)$	0.68	0.84	0.83	0.85	0.81	0.73	0.04
$\rho(MOM_{6,1}, C)$	0.63	0.84	0.82	0.83	0.81	0.74	0.01
$\rho(MOM_{12,1}, C)$	0.67	0.85	0.81	0.87	0.82	0.74	0.07

	Momentum portfolios						
	Low	2	3	4	5	High	H–L
$\rho(MOM_{1,1}, MOM_{6,1})$	0.77	0.83	0.88	0.85	0.83	0.79	0.45
$\rho(MOM_{1,1}, MOM_{12,1})$	0.66	0.81	0.86	0.87	0.80	0.78	0.28
$\rho(MOM_{6,1}, MOM_{12,1})$	0.82	0.89	0.89	0.89	0.91	0.89	0.73

C. Double sorts

We double-sort currencies into portfolios

- first, depending on interest rate differentials (along the median)
- then, depending on lagged excess returns (3 portfolios)

This yields a total of six portfolios and we can track momentum returns within high and low interest rate currencies.

C. Double sorts

	Example: $f = 1, h = 1$			
	M_L	M_M	M_H	$\triangle_M$
FD_L	-4.52	-0.90	0.54	5.06
	[-2.90]	[-0.55]	[0.34]	[3.81]
FD_H	0.64	3.20	6.00	5.36
	[0.34]	[1.68]	[3.18]	[3.30]
$\triangle_{FD}$	5.16	4.10	5.45	10.52
	[4.00]	[3.43]	[3.89]	[6.82]

Results are very similar for other formation and holding periods.

Momentum returns are almost identical in carry trade funding and investment currencies.

D. Cross-sectional regressions

We run Fama-MacBeth cross-sectional regressions to separate the effect of interest rate differentials and return momentum.

For each month t in our sample, we estimate (variants of)

$$rx_{t+1}^k = \alpha + \beta_{rx} rx_{t+1-\ell;t}^k + \beta_{FD}(f_t - s_t) + \beta_{\Delta s} \Delta s_{t+1-\ell;t}^k + \varepsilon_{t+1}$$

and then perform inference on the time-series of estimated parameters in the standard way (see e.g. Gutierrez and Kelley, 2008).

D. Cross-sectional regressions: Excess returns

Dependent: Excess returns, $\ell = 1$				
const.	rx	$f - s$	Δs	R^2
-0.02	0.16			0.15
[-0.17]	[5.65]			(0.01)
0.00		0.63		0.14
[0.01]		[4.87]		(0.01)
0.02			0.13	0.13
[0.22]			[4.46]	(0.01)
-0.07	0.12	0.57		0.26
[-0.76]	[4.42]	[4.68]		(0.01)
-0.07		0.68	0.14	0.26
[-0.72]		[5.89]	[4.82]	(0.01)

Results are very similar for other values of ℓ, i.e. for the impact of lagged returns or spot rates changes computed over more than just one month.

D. Cross-sectional regressions: Spot rate changes

Dependent: Spot rate changes, $\ell = 1$				
const.	rx	$f - s$	Δs	R^2
-0.16	0.08			0.13
[-1.52]	[2.95]			(0.01)
0.00		-0.37		0.09
[0.01]		[-2.89]		(0.01)
-0.16			0.13	0.14
[-1.59]			[4.55]	(0.01)
-0.07	0.12	-0.43		0.20
[-0.76]	[4.42]	[-3.52]		(0.01)
-0.07		-0.32	0.14	0.21
[-0.72]		[-2.83]	[4.82]	(0.01)

Again, similar results for other values of ℓ.

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Sources of momentum profits

Momentum profits could potentially stem from:

- Risk premia
- "Investor behavior" (under- and/or overreaction)

A. (Macro) Risk?

Do standard sources of risk explain momentum returns?

Evidence for stock markets (Chordia/Shivakumar, 2002, Griffin et al., 2003) and currency carry trades (Lustig/Verdelhan, 2007, Burnside et al., 2008) on this subject is rather mixed.

Hence, we present some general measures to judge the overall importance of standard risk factors for capturing currency momentum returns.

A. (Macro) Risk?

Panel A: Univariate regressions

	$MOM_{1,1}$			$MOM_{6,1}$			$MOM_{12,1}$		
	α	β	R^2	α	β	R^2	α	β	R^2
Employment	**10.57**	-0.72	0.00	**7.74**	0.62	0.00	**5.86**	0.23	0.00
ISM	**9.46**	0.04	0.00	**8.60**	0.03	0.00	**6.14**	0.04	0.00
IP	**9.72**	0.11	0.00	**8.72**	0.04	0.00	**6.26**	0.03	0.00
CPI	**11.73**	-0.55	0.00	**9.11**	-0.12	0.00	**6.60**	-0.10	0.00
M2	**9.97**	0.34	0.00	**8.68**	0.02	0.00	**6.18**	-0.01	0.00
Disp Inc	**9.33**	0.07	0.00	**8.42**	0.10	0.00	**5.95**	0.10	0.00
TED	**13.64**	**-0.38**	0.01	**11.95**	-0.30	0.01	**9.73**	-0.32	0.01
Term	4.48	**0.22**	0.01	**7.54**	0.05	0.00	5.05	0.05	0.00
HML_{FX}	**9.50**	0.04	0.00	**8.65**	0.02	0.00	**6.21**	0.08	0.00
FX_{VOL}	**11.70**	-0.44	0.00	**18.75**	-2.04	0.01	**27.59**	**-4.29**	0.04

Panel B: Multivariate regressions

	$MOM_{1,1}$			$MOM_{6,1}$			$MOM_{12,1}$		
	α	β	R^2	α	β	R^2	α	β	R^2
MKTRF	**8.73**	0.00	0.00	**8.02**	0.04	0.00	**5.16**	0.02	0.00
SMB		0.97			-0.54			0.71	
HML		0.06			0.01			0.06	
UMD		0.02			0.03			0.04	

B. Underreaction and overreaction

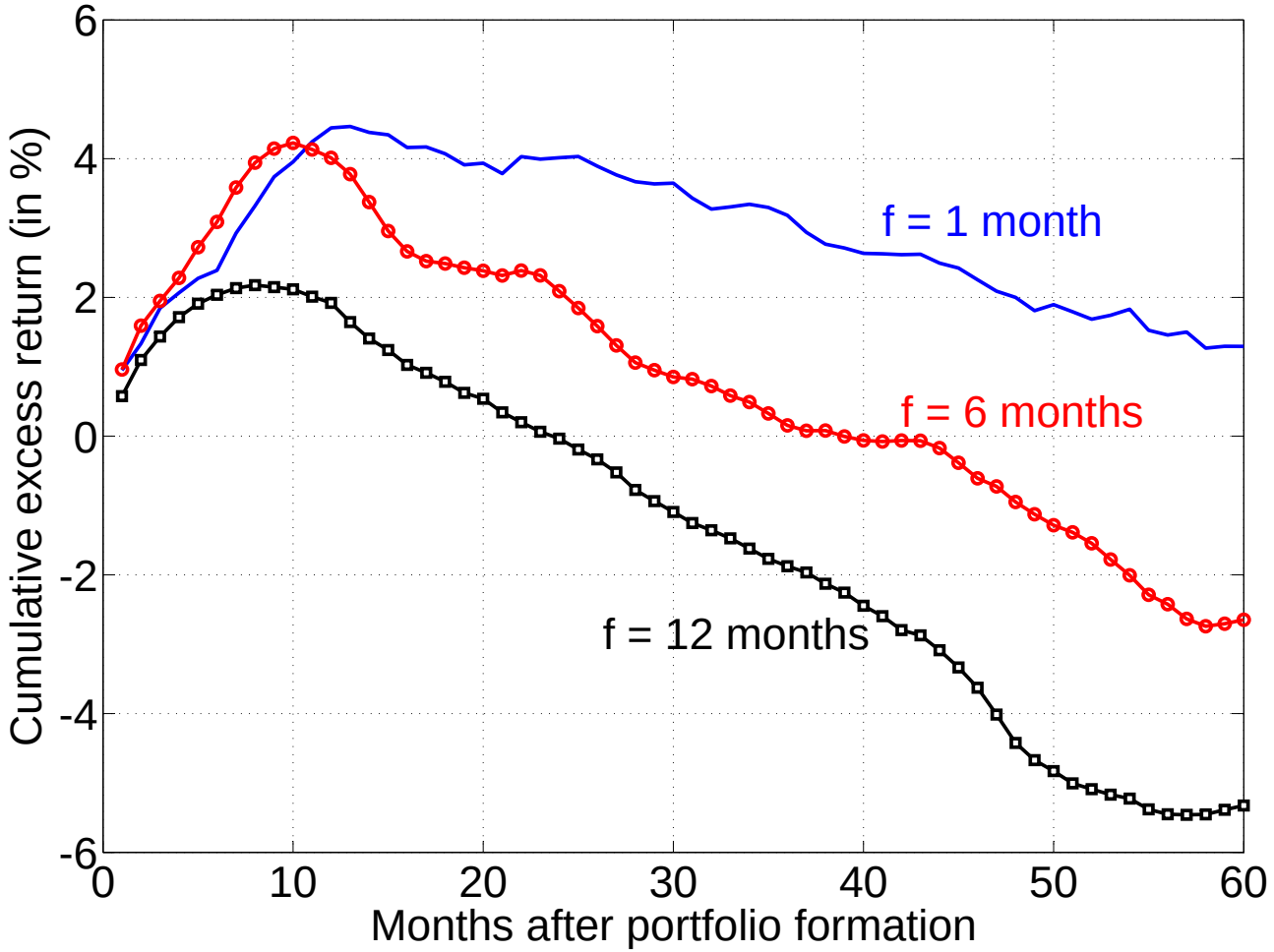
Jegadeesh and Titman hypothesize that momentum profits could be due to

- initial underreaction to news
- subsequent overreaction to a string of high (low) returns

Under this explanation, one would expect to see a clear pattern in post-formation returns of momentum returns.

Chui, Titman, and Wei (2010) recently showed for international stock markets that underreaction (aka slow information processing) seems to be important.

B. Underreaction and overreaction: Post-formation returns



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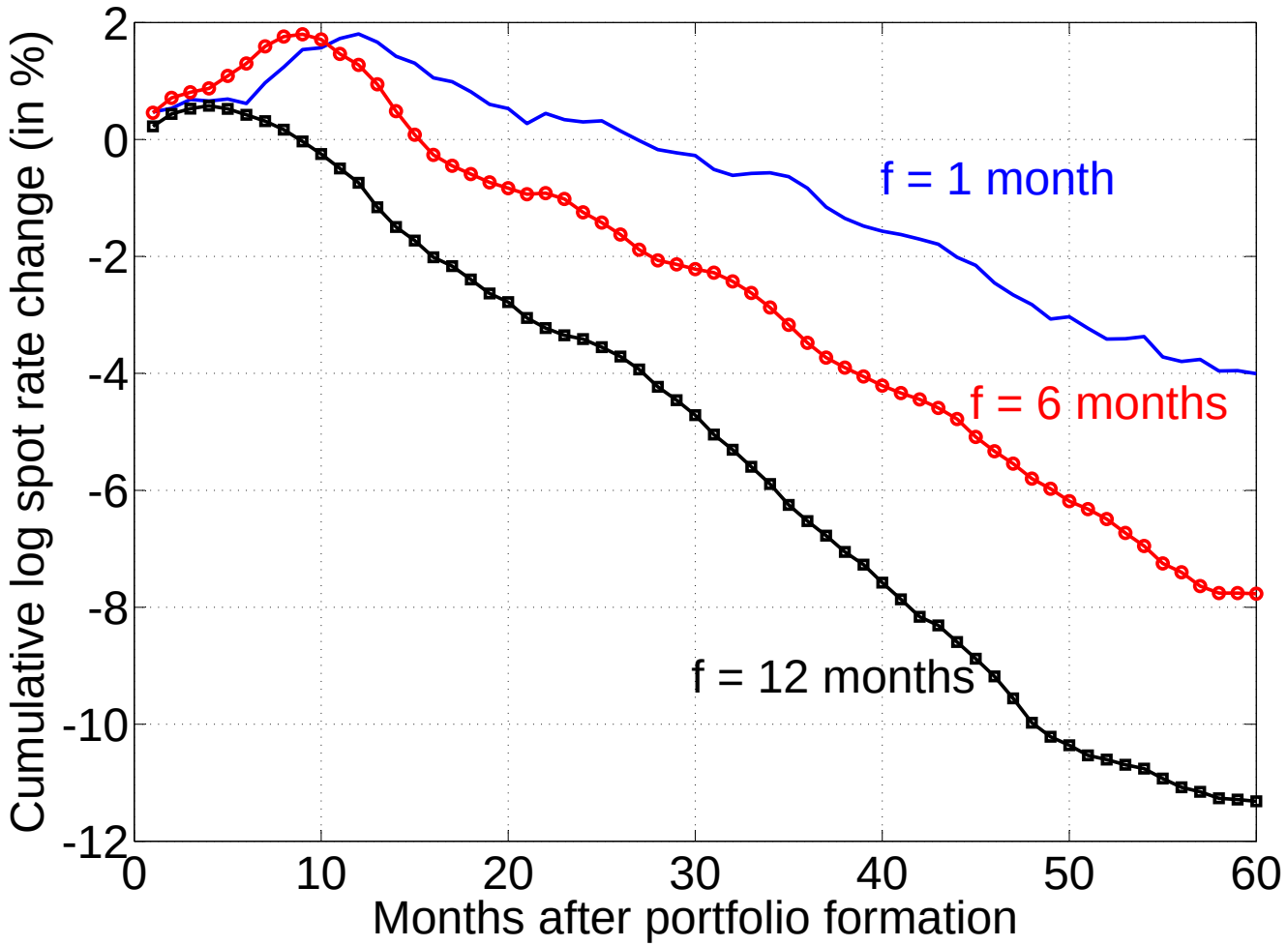

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4. **Understanding momentum returns**

Understanding momentum returns in currency markets

Currency momentum returns are large and basically unrelated to standard business cycle risk.

There seems to be some underreaction and overreaction in currency prices.

Can these returns be exploited? If not, why?

1. Transaction costs?
2. Limits to arbitrage?

A. Transaction costs

Most papers on stock market momentum do not adjust for transaction costs. Papers that do, find that transaction costs matter (e.g. Lesmond et al., 2004, Korajczyk/Sadka, 2004).

We have data on quoted bid-ask spreads available for the full sample period, all currencies, and for both spot and forward rates.

We use as effective spreads 100%, 75%, and 50% of the quoted spread (Goyal/Saretto, 2009) since it is well known that quoted spreads are too high compared to effective spreads (e.g. Lyons, 2001).

A. Transaction costs

	100% of quoted spread				
	Holding period h				
$f =$	1	3	6	9	12
1	3.92	2.02	1.26	0.38	0.39
	[2.20]	[1.16]	[0.61]	[0.18]	[0.20]
3	4.41	2.12	0.88	0.97	-0.07
	[2.39]	[1.20]	[0.53]	[0.58]	[-0.04]
6	3.86	2.12	-0.27	-0.92	-1.28
	[2.09]	[1.19]	[-0.15]	[-0.49]	[-0.67]
9	2.48	2.43	0.99	-0.40	-1.06
	[1.26]	[1.27]	[0.51]	[-0.21]	[-0.54]
12	1.40	0.80	-1.46	-1.98	-2.44
	[0.74]	[0.45]	[-0.84]	[-1.11]	[-1.31]

A. Transaction costs

	50% of quoted spread				
	Holding period h				
$f =$	1	3	6	9	12
1	6.64	4.47	3.77	2.69	3.00
	[3.76]	[2.62]	[1.89]	[1.36]	[1.61]
3	6.81	4.20	2.83	2.74	2.00
	[3.76]	[2.45]	[1.72]	[1.68]	[1.23]
6	6.20	4.23	1.68	1.21	0.92
	[3.43]	[2.41]	[0.94]	[0.66]	[0.49]
9	4.85	4.69	3.33	1.75	1.24
	[2.53]	[2.52]	[1.76]	[0.93]	[0.64]
12	3.80	3.13	0.78	0.09	-0.28
	[2.07]	[1.81]	[0.45]	[0.05]	[-0.15]

A. Transaction costs: Turnover

All countries						
		Holding period h				
f	PF	1	3	6	9	12
1	High	74.3	24.5	12.2	7.9	5.9
	Low	72.2	26.0	13.1	8.8	6.5
	All	77.8	26.3	13.4	8.6	6.4
6	High	29.9	17.7	12.6	8.4	6.8
	Low	31.1	17.6	12.3	8.4	6.7
	All	48.4	22.3	13.0	8.6	6.7
12	High	21.9	12.0	9.2	8.1	6.5
	Low	20.3	12.5	8.8	6.8	6.0
	All	37.2	18.0	11.4	8.4	6.6

Very high portfolio turnover for strategies with high average excess returns (e.g. for $f = 1, h = 1$).

A. Transaction costs: Spread differentials

All countries						
		Holding period h				
f	PF	1	3	6	9	12
1	High	2.6	1.4	1.0	0.1	0.8
	Low	3.1	2.1	1.4	0.4	0.8
6	High	2.6	1.0	0.4	0.9	0.1
	Low	4.1	0.6	0.1	0.4	0.4
12	High	3.3	0.9	0.3	0.0	0.1
	Low	6.9	2.4	0.9	0.6	0.6

Bid-ask spreads are relatively higher for winner (High) and loser (Low) currencies compared to average bid-ask spreads across all currencies (e.g. 2.6 basis points higher for winner currencies in a momentum strategy with $f = 1, h = 1$ compared to all currencies). ▸ Bid-ask spreads over time

B. Limits to Arbitrage

Do limits-to-arbitrage prevent exploitation of momentum profits?

There are no short-selling constraints in FX markets, but arbitrage is still risky in positions that

1. are likely to yield negative returns over short horizons
2. are hard to hedge.

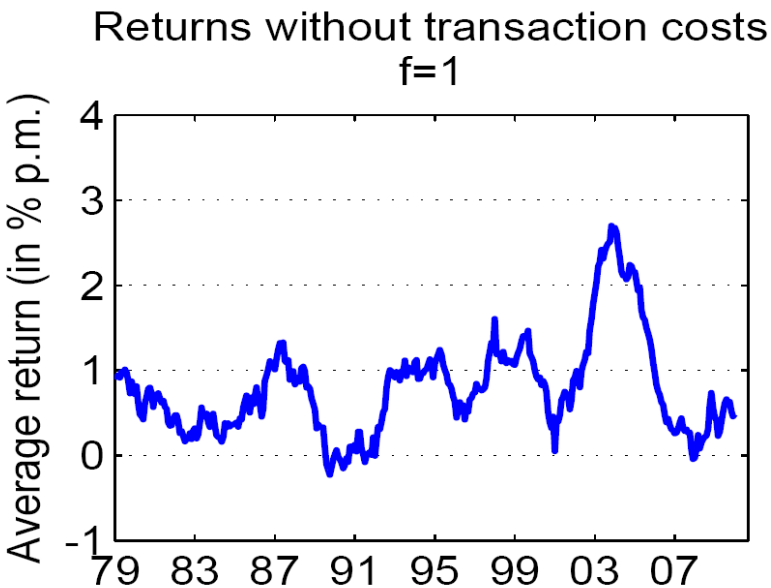
Hence, we would expect to see higher momentum profits in currencies that are hard to arbitrage. We focus on

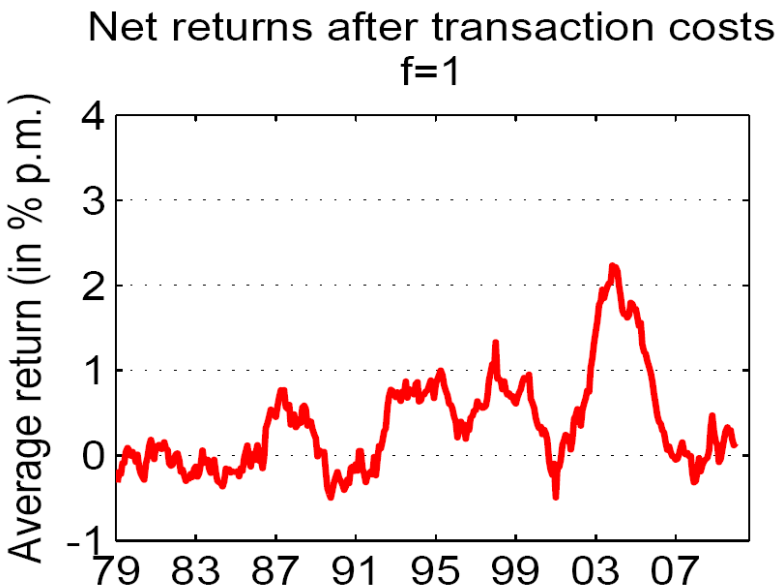
1. time-variation in momentum profits
2. proxies for feasibility of conducting arbitrage
   - idiosyncratic volatility
   - country risk ratings
   - exchange rate stability risk ratings

to proxy for limits to arbitrage.

B. Limits to Arbitrage: Time-variation in returns

Example: Rolling 36-months average returns for $f = h = 1$.





B. Limits to Arbitrage: Double Sorts

Idiosyncratic volatility (IVOL) is computed as the absolute value of the time-series residual from a pricing model for currencies (e.g. Lustig et al., 2010).

	IVOL and Momentum, $f = h = 1$			
	M_L	M_M	M_H	$\triangle_M$
$IVOL_L$	-1.04	0.92	2.93	3.97
	[-0.65]	[0.55]	[1.75]	[2.81]
$IVOL_H$	-3.52	1.00	4.57	8.09
	[-1.83]	[0.57]	[2.48]	[4.72]
$\triangle_{IVOL}$	-2.48	0.07	1.64	5.61
	[-1.86]	[0.07]	[1.28]	[3.72]

Similar results for other combinations of f and h. Momentum returns are higher in currencies with high idiosyncratic risk.

B. Limits to Arbitrage: Double sorts

Country risk ratings (CRISK) are taken from the ICRG from PRS Group (see e.g. Bekaert et al., 2007).

	CRISK and Momentum, $f = h = 1$			
	M_L	M_M	M_H	$\triangle_M$
$CRISK_L$	0.01	3.41	4.51	4.50
	[0.01]	[1.78]	[2.52]	[3.12]
$CRISK_H$	-0.67	3.82	8.04	8.72
	[-0.34]	[1.90]	[3.72]	[4.19]
$\triangle_{CRISK}$	-0.68	0.41	3.53	4.22
	[-0.46]	[0.35]	[2.21]	[2.12]

Similar results for other combinations of f and h. Momentum returns are higher in currencies with high country risk ratings.

B. Limits to Arbitrage: Double sorts

Exchange rate stability ratings (XSTAB) are taken from the ICRG from PRS Group and measure the risk of a sharp currency movement.

	XSTAB and Momentum, $f = h = 1$			
	M_L	M_M	M_H	$\triangle_M$
$XSTAB_L$	1.27	0.15	3.25	1.98
	[0.83]	[0.10]	[2.17]	[1.39]
$XSTAB_H$	-0.48	4.04	6.09	6.56
	[-0.24]	[2.02]	[3.09]	[4.06]
$\triangle_{XSTAB}$	-1.75	3.89	2.84	4.59
	[-1.06]	[2.47]	[1.58]	[2.44]

Similar results for other combinations of f and h. Momentum returns are higher in currencies with high risk of exchange rate instability.

B. Limits to Arbitrage: Large countries

If limits to arbitrage matter, we should expect to see low momentum returns in currencies of highly developed countries with "low risk".

To examine this, we compute momentum returns for a subset of 15 highly developed countries, look at a recent period (1992 – 2010) with high market integration, and take transaction costs into account:

	Excess returns (with b/a)				
	Holding period h				
f =	1	3	6	9	12
1	-0.73	2.16	0.79	-0.27	1.38
	[-0.32]	[0.93]	[0.34]	[-0.10]	[0.54]
3	1.38	-0.24	-1.82	-0.84	2.20
	[0.61]	[-0.10]	[-0.73]	[-0.35]	[0.90]
6	-1.19	-0.45	0.84	2.29	4.70
	[-0.53]	[-0.20]	[0.35]	[0.80]	[1.58]
9	1.29	0.45	0.35	0.51	0.46
	[0.52]	[0.19]	[0.13]	[0.20]	[0.18]
12	1.23	1.30	-1.06	1.37	-1.14
	[0.48]	[0.53]	[-0.42]	[0.63]	[-0.51]

Conclusions

1. On the face of it, currency momentum returns look similar to momentum returns in stock markets.
2. Hence, momentum returns extend to highly sophisticated, less constrained and much larger currency markets as well.
3. Moreover, there is evidence of slow information processing in winner and loser currencies.
4. However, momentum profits are
   - clearly lower after reasonable transaction costs.
   - strongly time-varying
   - concentrated in currencies that have high lagged levels of idiosyncratic volatility and high risk ratings.

Sample countries

Australia	Austria	Belgium	Brazil	Bulgaria
Canada	Croatia	Cyprus	Czech Rep.	Denmark
Egypt	Euro area	Finland	France	Germany
Greece	Hong Kong	Hungary	India	Indonesia
Ireland	Israel	Italy	Iceland	Japan
Kuwait	Malaysia	Mexico	Netherlands	N. Zealand
Norway	Philippines	Poland	Portugal	Russia
Saudi Arabia	Singapore	Slovakia	Slovenia	S. Africa
South Korea	Spain	Sweden	Switzerland	Taiwan
Thailand	Ukraine	U.K.		

Total sample consists of 48 countries. Developed country sample: 15 countries highlighted in blue

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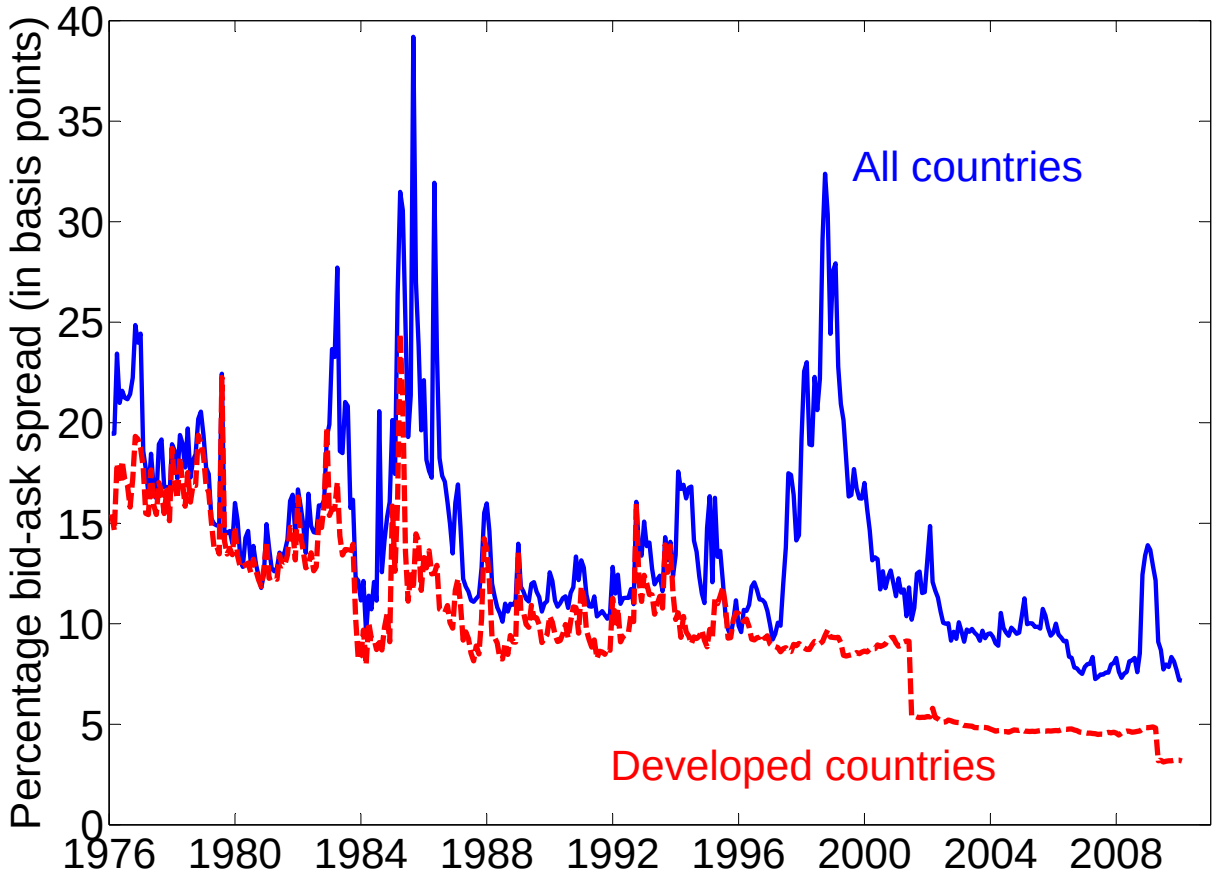
Bid-ask spreads over time



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