

Microstructure effects, bid-ask spreads and volatility in the spot foreign exchange market pre- and post-EMU

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Why Does This Research Matter?

- Price Clustering
- Debate Surrounding Observed Increases in FX Bid-Ask Spreads After-EMU

Why did bid-ask spread rise after EMU?

- Price Transparency
 - Hau, Killeen and Moore(2002)
- Price Granularity
 - Goodhart, Love, Payne and Rime(2002)

Comparing Transaction Costs Pre- & Post-EMU

- % bid-ask spread = $100 * \frac{\text{ask} - \text{bid}}{\text{traded price}}$
- Compare EUR with pre-EMU DEM

EBS

- Larger of the 2 Electronic Inter-Dealer Broking Service Providers
- Dominant in non-Scandinavian & non-British Exchange Rates
- “Electronic Exchange”

EBS Dealing Screen

TMSQ TRC		Apr11 19:50		DOSO		BANK OF M	
eur/usd	0.96 26	27	0.96	11-Apr	Rates		
26	26	27	27		EUR/USD 0.9626-27	EUR/CHF 1.5715-16	
	bid	offer			USD/JPY 106.97-98	GBP/USD 1.5863-65	
usd/jpy	106. 97	98	106.	11-Apr	EUR/JPY 102.96-97	EUR/GBP 0.6061-64	
97	97	98	99		USD/CHF 1.6335-36	EUR/SEK 8.2890-99	
	bid	offer			Trader Deals		
eur/jpy	102. 96	97	102.	11-Apr	19:29 SELL 10 106.97 JPSN USD/JPY		
96	96	97	97		19:31 BUY 5 106.96 WORN USD/JPY		
	bid	offer			19:32 SELL 10 0.9626 CHRN EUR/USD		
usd/chf	1.63 35	36	1.63	11-Apr	19:32 SELL 5 1.6335 WORN USD/CHF		
35	35	36	36		19:34 BUY 10 0.9627 EUUB EUR/USD		
	bid	offer			19:34 SELL 5 0.9627 UORN EUR/USD		
eur/chf	1.57 16	17	1.57	11-Apr	19:45 SELL 10 0.9627 WOSN EUR/USD		
15	16	17	17		19:46 BUY 5 0.9626 WORS EUR/USD		
	bid	offer			19:46 BUY 10 0.9626 RAWO EUR/USD		
gbp/usd	1.58 63	65	1.58	11-Apr	19:49 SELL 5 106.96 RAUB USD/JPY		
63	63	65	65		EBS Deals		
	bid	offer			19:35 0.9620 Given EUR/USD		
					19:35 0.9623 Paid EUR/USD		
					19:36 0.9620 Given EUR/USD		
					19:36 0.9623 Paid EUR/USD		
					19:41 0.9628 Paid EUR/USD		
					19:41 0.9626 Given EUR/USD		
					19:41 0.9615 Given EUR/USD		
					19:45 0.9627 Paid EUR/USD		
					19:46 0.9626 Given EUR/USD		
					19:46 0.9626 Given EUR/USD		
					EUR/USD .96 26 BID		
					04062 Buy 5 @ 0.9626 ABEU		
					DONE		
					clear 15 of 15 2B3+11		

Unique EBS Data Set

- Pre-EMU: August 1998
- Post-EMU: August 1999
- Rates: EUR(DEM)/USD, USD/JPY, EUR(DEM)/JPY, EUR(DEM)/CHF and USD/CHF
- Quotes (- Best Bid & Ask) & Trades (- Side of Initiator is Given)
- Frequency: per second
- Not Provided: Volumes, Trader Identifiers

New Tests for Price Clustering

- Attraction Hypothesis

$$\frac{\text{Min}((\text{Av}(\phi_{3,7}) - \text{Av}(\phi_{2,8})), (\text{Av}(\phi_{2,8}) - \text{Av}(\phi_{4,6})), (\text{Av}(\phi_{4,6}) - \text{Av}(\phi_{1,9}))))}{\text{Av}((\phi_3 - \phi_7), (\phi_2 - \phi_8), (\phi_4 - \phi_6), (\phi_1 - \phi_9))}$$

- Price Resolution Hypothesis

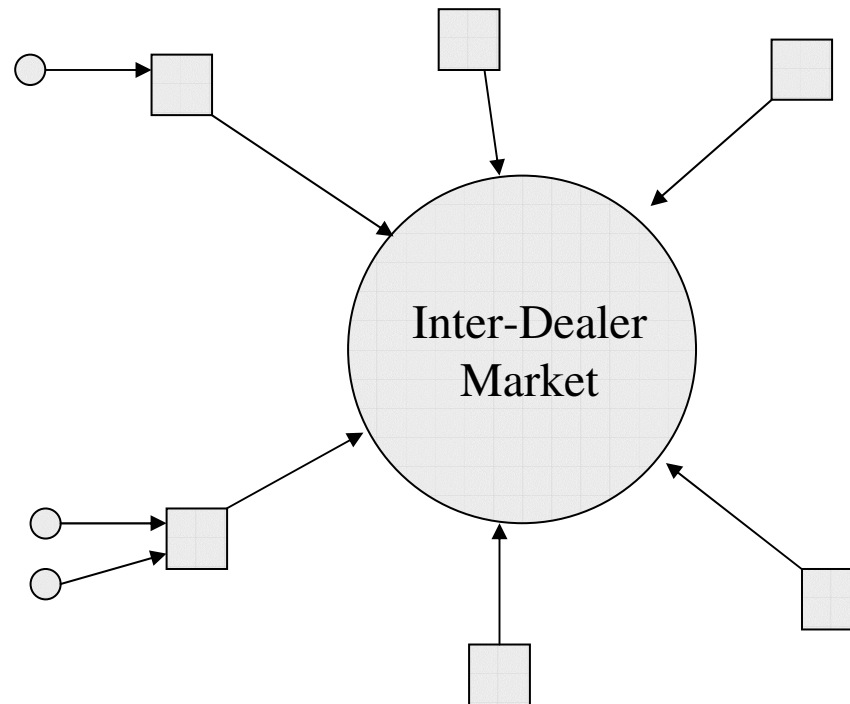
$$\frac{\text{Av}(\phi_{2,3,7,8}) - \text{Av}(\phi_{1,4,6,9})}{\text{Max}(\text{Max}(\phi_{2,3,7,8}) - \text{Min}(\phi_{2,3,7,8}), \text{Max}(\phi_{1,4,6,9}) - \text{Min}(\phi_{1,4,6,9}))}$$

Summary Statistics

Hourly Average	USD/JPY			USD/CHF			EUR(DEM)/USD		
	98	99	%Δ	98	99	%Δ	98	99	%Δ
AS	0.72(0.1513)	0.91(0.1689)	26%	1.58(0.456)	1.15(0.2646)	-27%	0.42(0.0964)	0.66(0.081)	57%
TWAS	0.81(0.2363)	0.92(0.2304)	14%	1.75(0.6984)	1.24(0.4316)	-29%	0.41(0.107)	0.65(0.1099)	59%
ASPIP	1.03(0.2082)	1.03(0.1833)	0%	2.35(0.6651)	1.73(0.4003)	-26%	0.75(0.1678)	0.69(0.0847)	-8%
TWASPIP	1.16(0.3281)	1.04(0.2549)	-10%	2.59(1.0205)	1.87(0.6546)	-28%	0.73(0.1864)	0.69(0.1159)	-5%
TRAD	846(520)	507(305)	-40%	148(115)	240(150)	62%	1367(672)	933(465)	-32%
ABIM	67.18(56.4131)	30.37(24.1556)	-55%	17.59(16.5925)	15.98(13.2052)	-9%	89.65(58.7582)	33.03(25.3438)	-63%
VOLAT	0.0456(0.0264)	0.037(0.018)	-19%	0.0363(0.0211)	0.0325(0.0135)	-10%	0.0324(0.018)	0.0308(0.0126)	-5%
STDSP	0.89(0.1829)	0.92(0.1846)	3%	1.29(0.2064)	1.06(0.1628)	-18%	0.49(0.1129)	0.64(0.0854)	31%
STDSPPIP	1.27(0.2432)	1.04(0.2016)	-18%	1.92(0.2859)	1.6(0.2461)	-17%	0.87(0.1955)	0.68(0.0897)	-22%
ATG	0.85	1.42	67%	4.86	3.00	-38%	0.53	0.77	47%

Hourly Average	EUR(DEM)/JPY			EUR(DEM)/CHF			Goodhart et al. : EUR(DEM)/USD		
	98	99	%Δ	98	99	%Δ	97	99/00	%Δ
AS	1.32(0.3796)	2.09(0.5914)	58%	0.76(0.219)	0.57(0.1411)	-25%	1.62(0.4783)	2.77(1.2823)	71%
TWAS	1.42(0.5364)	2.27(0.9489)	60%	0.77(0.398)	0.59(0.2482)	-23%	1.45(0.531)	2.67(1.4189)	84%
ASPIP	1.06(0.2982)	2.5(0.7)	136%	0.63(0.1791)	0.91(0.2256)	44%	2.84(0.8339)	2.82(1.2843)	-1%
TWASPIP	1.14(0.4255)	2.72(1.1293)	139%	0.64(0.3303)	0.94(0.397)	47%	2.53(0.9274)	2.71(1.4305)	7%
TRAD	332(193)	117(84)	-65%	237(149)	96(56)	-59%	602.74(313.279)	289.55(146.127)	-52%
ABIM	26.98(24.0536)	16(14.5088)	-41%	22.08(20.5351)	9.9(9.0706)	-55%	51(47)	30(27)	-41%
VOLAT	0.0422(0.0203)	0.0408(0.0193)	-3%	0.0186(0.0096)	0.0065(0.003)	-65%	0.0318(0.05996)	0.0387(0.058)	22%
STDSP	1.53(0.4376)	1.56(0.253)	2%	0.88(0.3264)	0.49(0.1479)	-44%	1.11(0.0566)	2(1.7955)	80%
STDSPPIP	1.23(0.3414)	1.87(0.2935)	52%	0.73(0.268)	0.79(0.2366)	8%	1.93(0.9888)	2.03(1.8531)	5%
ATG	2.17	6.15	184%	3.04	7.50	147%			

Structure of the FX Market



FX Banks



Customers of FX Banks, e.g. Fund Managers, Corporates, Hedge Funds

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How Can Transaction Costs Change?

- % bid-ask spread = $100 * \frac{\text{ask} - \text{bid}}{\text{traded price}}$
- 3 Reasons (ask-bid) Could Change:
 - Price Discreteness
 - Price Clustering
 - Non-Synchronous Pricing

Price Level Change Vs Price Discreteness

(A) EUR & DEM	98				99			% Change in Min. Tick Value	% Change in Currency Value
	Min Tick	Av. Rate*	Basis Pts		Min. Tick	Av. Rate	Basis Pts		
USD/DEM	0.0001	1.8430	0.5426	EUR/USD	0.0001	1.0612	0.9423	74%	4%
DEM/JPY	0.005	60.957	0.8203	EUR/JPY	0.01	119.22	0.8388	2%	-24%
DEM/CHF	0.00005	0.8181	0.6112	EUR/CHF	0.0001	1.6001	0.6250	2%	-2%
<i>(B) non-EUR(DEM)</i>									
USD/JPY	0.01	112.74	0.8870	USD/JPY	0.01	112.74	0.8870	0%	-21%
USD/CHF	0.0001	1.5075	0.6634	USD/CHF	0.0001	1.5075	0.6634	0%	2%

Bid-Ask Spread Clustering

		<u>0</u>	<u>½</u>	<u>1</u>	<u>1½</u>	<u>2</u>	<u>2½</u>	<u>3</u>	<u>3½</u>	<u>4</u>	<u>4½</u>	<u>5</u>	<u>5½</u>	<u>6+</u>
USD/JPY	<u>98</u>	50%		23%		15%		6%		2%		2%		2%
USD/JPY	<u>99</u>	36%		40%		16%		5%		1%		1%		1%
USD/CHF	<u>98</u>	29%		12%		18%		13%		6%		8%		13%
USD/CHF	<u>99</u>	29%		23%		23%		11%		4%		4%		6%
USD/DEM	<u>98</u>	47%		34%		12%		3%		1%		1%		1%
EUR/USD	<u>99</u>	41%		49%		9%		1%		0%		0%		0%
DEM/JPY	<u>98</u>	39%	6%	27%	3%	12%	1%	5%	0%	2%	0%	1%	0%	3%
EUR/JPY	<u>99</u>	21%		15%		22%		14%		7%		7%		13%
DEM/CHF	<u>98</u>	37%	26%	22%	4%	5%	1%	2%	0%	1%	0%	0%	0%	1%
EUR/CHF	<u>99</u>	31%		51%		12%		3%		1%		1%		1%

Chi-Squareds & Standard Ranges

(A) Trade Price Data			
χ^2 (No. of Obs.)	Pre	Post	% Δ
USD/JPY	79,729 (399,187)	15,195 (225,825)	-81%
USD/CHF	15,009 (42,952)	13,783 (72,939)	-8%
EUR(DEM)/USD	24,658 (484,006)	2,809 (310,300)	-89%
EUR(DEM)/JPY	6,025 (128,064)	12,046 (42,743)	100%
EUR(DEM)/CHF	464 (73,898)	317 (29,654)	-32%
(B) Quoted Price Data			
χ^2 (No. of Obs.)	Pre	Post	% Δ
USD/JPY	77,074 (819,673)	17,116 (633,963)	-78%
USD/CHF	90,466 (251,624)	66,874 (399,722)	-26%
EUR(DEM)/USD	20,535 (771,614)	3,567 (540,868)	-83%
EUR(DEM)/JPY	21,846 (495,771)	103,619 (329,584)	374%
EUR(DEM)/CHF	1,516 (232,362)	1,552 (121,166)	2%

(A) Trade Price Data			
Std. Range	Pre	Post	% Δ
USD/JPY	1.34	0.79	-41%
USD/CHF	1.81	1.34	-26%
EUR(DEM)/USD	0.71	0.34	-52%
EUR(DEM)/JPY	0.69	1.65	139%
EUR(DEM)/CHF	0.28	0.38	39%
(B) Quoted Price Data			
Std. Range	Pre	Post	% Δ
USD/JPY	0.93	0.52	-44%
USD/CHF	1.82	1.22	-33%
EUR(DEM)/USD	0.53	0.29	-44%
EUR(DEM)/JPY	0.62	1.73	177%
EUR(DEM)/CHF	0.29	0.41	44%

Price Resolution: Our New Test

(A) Trade Price Data			
Resolution	Pre	Post	% Δ
USD/JPY	2.23	1.47*	-34%
USD/CHF	2.49	2.03	-19%
EUR(DEM)/USD	1.33*	0.50*	-62%
EUR(DEM)/JPY	1.34	1.78	33%
EUR(DEM)/CHF	0.52*	0.24*	-54%

(B) Quoted Price Data			
Resolution	Pre	Post	% Δ
USD/JPY	2.06	1.60*	-22%
USD/CHF	2.27	1.97	-13%
EUR(DEM)/USD	1.48*	0.52*	-65%
EUR(DEM)/JPY	1.86	2.05	10%
EUR(DEM)/CHF	0.85*	0.57*	-32%

Conclusions

- EUR/USD – Change in Price Discreteness due to Inversion of Quote Format
- USD/JPY – Exchange Rate Level Change
- EUR/JPY, EUR/CHF & USD/CHF – Shift in international vehicle currency volumes from DEM to USD, instead of to EUR.