

Internet Appendix

How do shocks arise and spread across stock markets? A microstructure perspective

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Abstract

This internet appendix presents a summary of the sample description and filters used in the paper as well as dis-aggregated summary statistics of our sample by market. The following additional analyses of how sudden, market-wide shocks arise and spread across international stock markets are included in this internet appendix: spillovers of jumps in prices, liquidity, and trading activity across markets; behavior of prices, liquidity and trading activity around 5-minute jumps in respective variables for different sub-samples; behavior of prices, liquidity, and trading activity around 15-minute and 1-hour jumps in prices (instead of the 5-minute frequency); and sub-period analyses at the 5-minute frequency (1996-2006 vs. 2007-2011).

IA.1. Sample description and filters

Tables [IA.1](#) – [IA.3](#) provide summaries of the sample description, stock-level filters, and market-level filters, respectively.

IA.2. Summary statistics by market

Table [IA.4](#) (equivalent of Table 1 in the paper) provides dis-aggregated summary statistics for value-weighted returns, proportional quoted spreads (*PQSPR*), order imbalance (*OIB*), and turnover for each of the 12 markets under consideration during 1996-2011 at 5-minute frequency.

IA.3. Spillovers of jumps in prices, liquidity, and trading activity across markets at 5-minute frequency

Table [IA.5](#) shows how jumps in prices, *PQSPR*, and *OIB* spillover to other markets within the region.

IA.4. Behavior of prices, liquidity, and trading activity around jumps in the same variables

Figures [IA.1](#) and Figure [IA.2](#) show the behavior of prices, *PQSPR*, and *OIB* around 15-minute and 1-hour jumps in prices, respectively (equivalent of Figure 1 in the paper). Figure [IA.3](#) show the behavior of prices, *PQSPR*, and *OIB* around 5-minute simultaneous jumps in prices and *OIB*. Figure [IA.4](#) shows the behavior of prices, *PQSPR*, and *OIB* around 5-minute jumps in prices that do not occur around macro announcements. Figure [IA.5](#) show the behavior of prices, *PQSPR* and *OIB* around transitory 5-minute jumps in prices. We classify jumps in prices that revert by less than one third (more than two thirds) as permanent (transitory) jumps based on the one-hour window after the jump; all other jumps are unclassified. Figure [IA.6](#) (Figure [IA.7](#)) shows the behavior of liquidity (trading activity) and prices around 5-minute jumps in liquidity (trading activity).

IA.5. Sub-period analysis at 5-minute frequency: 1996-2006 vs. 2007-2011

We split our sample into two periods: 1996-2006 and 2007-2011 (such unequal sample split is determined by the availability of the macro announcements data). We redo our analyses for these two sub-periods at 5-minute frequency. We report Table [IA.6](#) which is equivalent of Table 2 in the paper, Table [IA.7](#) which is equivalent of Table 3 in the paper, Figures [IA.8](#) – [IA.9](#) which are equivalent of Figure 1 in the paper, and Table [IA.8](#) which is equivalent of Table 4 in the paper.

Table IA.1: Sample description

This table provides sample description: stock exchange, main stock market index, number of unique tickers, data availability (after stock-level and market-level filters) and opening times of the stock exchange for the 12 markets used in our analysis (together with information on the timezone and offset relative to GMT with and without daylight-saving time). Data on quotes and trades are from TRTH. Only common stocks that were ever part of the major local equity index are included (data on index constituents are from the TRTH Speedguide, while common stocks are identified through Datastream).

Exchange	Index	# of unique tickers	Available from (after filters)	Opening times	Timezone	Offset w/o DST	Offset with DST
Panel A: America							
Brazil	Bolsa de Valores, Mercadorias & Futuros de Sao Paulo	BOVESPA	43	2006	from 2006-Jan-01 till 2011-Dec-31	13:00 20:00	GMT GMT GMT
Canada	Toronto Stock Exchange	TSX Composite	335	1996	from 1996-Jan-01 till 2011-Dec-31	9:30 16:00	EST GMT-5:00 GMT-4:00
Mexico	Bolsa Mexicana de Valores	IPC	60	1998	from 1998-Jan-01 till 2011-Dec-31	8:30 15:00	CST GMT-6:00 GMT-5:00
U.S.	New York Stock Exchange	S&P100	90	1996	from 1996-Jan-01 till 2011-Dec-31	9:30 16:00	EST GMT-5:00 GMT-4:00
Panel B: Asia							
Hong Kong	The Stock Exchange of Hong Kong Limited	HSI	66	1996	from 1996-Jan-01 till 2011-Mar-06	10:00 12:30	HKT GMT+8:00 GMT+8:00
					from 2011-Mar-07 till 2011-Dec-31	14:30 16:00 9:30 12:00	
India	National Stock Exchange of India	NIFTY50	128	2000	from 2000-Jan-01 till 2009-Dec-31	10:00 15:30	IST GMT+5:30 GMT+5:30
					from 2010-Jan-01 till 2011-Dec-31	9:00 15:30	
Japan	Tokyo Stock Exchange	NIKKEI225	307	1996	from 1996-Jan-01 till 2011-Nov-20	9:00 11:00	JST GMT+9:00 GMT+9:00
					from 2011-Nov-21 till 2011-Dec-31	12:30 15:00 9:00 11:30	
Malaysia	Bursa Malaysia	KLCI	157	1996	from 1996-Jan-01 till 1997-Dec-31	9:30 12:30	MYT GMT+8:00 GMT+8:00
					from 1998-Jan-01 till 2011-Dec-31	14:30 17:00 9:00 12:30	
						14:30 17:00	
Panel C: Europe / Africa							
France	Paris Euronext	CAC40	53	1996	from 1996-Jan-01 till 1999-Sep-30	10:00 17:00	CET GMT+1:00 GMT+2:00
					from 1999-Oct-01 till 2000-Mar-31	9:00 17:00	
					from 2000-Apr-01 till 2011-Dec-31	9:00 17:30	
Germany	Xetra	DAX30	41	1997	from 1997-Jan-01 till 1999-Sep-19	8:30 17:00	CET GMT+1:00 GMT+2:00
					from 1999-Sep-20 till 2011-Dec-31	9:00 17:30	
South Africa	Johannesburg Stock Exchange	JALSH	178	1997	from 1997-Jan-01 till 2001-Dec-31	9:00 16:00	SAST GMT+2:00 GMT+2:00
					from 2002-Jan-01 till 2011-Dec-31	9:00 17:00	
U.K.	London Stock Exchange	FTSE100	169	1996	from 1996-Jan-01 till 1997-Dec-31	8:30 16:30	GMT GMT GMT+1:00
					from 1998-Jan-01 till 1999-Dec-31	9:00 16:30	
					from 2000-Jan-01 till 2011-Dec-31	8:00 16:30	

Table IA.2: Stock-level filters

This table shows summary statistics of the stock-level filters applied to quote and trade data aggregated by the four regions (America, Asia, Europe/Africa, and World) during 1996-2011. Panel A shows the filters that are applied to quotes and Panel B shows filters that are applied to trades. Data on quotes and trades are from TRTH. Only common stocks that were ever part of the major local equity index are included (data on index constituents are from the TRTH Speedguide, while common stocks are identified through Datastream).

	America	Asia	Europe / Africa	World
Panel A: Quote filters				
Total # of quotes	15,563,480,441	3,248,545,800	8,370,062,567	27,182,088,808
# of quotes with either negative bid or ask prices	- 39,967	13,456,332	120,233	13,616,532
# of quotes with bid price higher than ask price	- 26,336	465,025	6,001,621	6,492,982
# of quotes with the bid or ask price larger by 10% compared to the 10 surrounding ticks or with the proportional bid-ask spread exceeding 25%	- 539,710	172,979	224,002	936,691
# of quotes that occur outside trading hours	- 26,361,838	75,691,743	64,026,732	166,080,313
# of quotes that occur during first and last 15 minutes	- 1,738,745,073	640,807,444	601,881,503	2,981,434,020
# of quotes used in the analysis	13,797,767,517	2,517,952,277	7,697,808,476	24,013,528,270
Panel B: Trade filters				
Total # of trades	2,052,527,477	1,567,514,284	1,733,246,334	5,353,288,095
# of trades with either negative trade price or trade size	- 1,497,214	66,109,503	3,840,411	71,447,128
# of block trades (trade size larger than 10,000)	- 1,332,555	8,483,814	4,834,424	14,650,793
# of trades with the trade price larger by 10% compared to the 10 surrounding ticks	- 26,154	22,035	58,466	106,655
# of trades that occur outside trading hours	- 11,621,185	18,509,745	23,267,374	53,398,304
# of trades that occur during first and last 15 minutes	- 284,708,518	284,615,285	148,871,492	718,195,295
# of trades used in the analysis	1,753,341,851	1,189,773,902	1,552,374,167	4,495,489,920

Table IA.3: Market-level filters

This table shows summary statistics of the market-level filters aggregated by the three regions (America, Asia, and Europe/Africa) per year during 1996-2011. Data on quotes and trades are from TRTH. Only common stocks that were ever part of the major local equity index are included (data on index constituents are from the TRTH Speedguide, while common stocks are identified through Datastream).

Year	America			Asia			Europe/Africa		
	# of 5 min intervals with <i>at least</i> 10 companies with quotes	# of intervals with <i>less</i> than 10 companies with trades	final # of 5 min intervals	# of 5 min intervals with <i>at least</i> 10 companies with quotes	# of intervals with <i>less</i> than 10 companies with trades	final # of 5 min intervals	# of 5 min intervals with <i>at least</i> 10 companies with quotes	# of intervals with <i>less</i> than 10 companies with trades	final # of 5 min intervals
1996	35,193	1,254	33,939	24,406	244	24,162	58,977	18,247	40,730
1997	35,178	287	34,891	31,120	251	30,869	61,264	19,473	41,791
1998	44,854	10,031	34,823	33,250	123	33,127	82,716	25,717	56,999
1999	53,726	15,493	38,233	33,776	111	33,665	84,835	7,355	77,480
2000	53,878	16,095	37,783	42,086	158	41,928	91,815	2,295	89,520
2001	52,259	16,341	35,918	47,242	481	46,761	88,739	2,214	86,525
2002	53,393	13,815	39,578	48,242	450	47,792	93,654	1,848	91,806
2003	58,414	19,807	38,607	48,266	352	47,914	94,214	858	93,356
2004	65,908	20,702	45,206	48,514	465	48,049	95,611	1,057	94,554
2005	73,772	24,110	49,662	48,764	246	48,518	96,126	335	95,791
2006	72,957	6,075	66,882	48,888	411	48,477	95,471	195	95,276
2007	73,104	536	72,568	48,791	280	48,511	94,984	226	94,758
2008	73,531	523	73,008	48,135	270	47,865	95,652	453	95,199
2009	73,154	500	72,654	48,312	86	48,226	95,370	239	95,131
2010	73,302	526	72,776	52,025	42	51,983	94,846	250	94,596
2011	62,952	251	62,701	54,155	60	54,095	91,875	168	91,707
Total	955,575	146,346	809,229	705,972	4,030	701,942	1,416,149	80,930	1,335,219

Table IA.4: Summary statistics of value-weighted returns, liquidity, and trading activity by market

This table shows the full-sample time-series mean, median, and standard deviation of 5-minute value-weighted log-returns in basis points (*RETURN*), value-weighted proportional quoted spreads (*PQSPR*) in percentage, value-weighted order imbalance (*OIB*) in basis points of previous month market capitalization, and value-weighted turnover (*TURNOVER*) in basis points of previous month market capitalization for 12 equity markets over 1996-2011. We refer to Section 2.2 and Appendix A for a detailed description of sample selection, data filters, and variable definitions. For the purpose of computing summary statistics only, we winsorize the time-series of returns, *PQSPR*, and *OIB* by region at 0.5% and 99.5% levels. We note that we use non-winsorized data for the jump estimation. The final row presents the total number of 5-minute intervals in the sample. Data to calculate these variables are from TRTH (trade and quote data) and Datastream (market capitalization data). Only common stocks that were ever part of the major local equity index are included in the computation of value-weighted returns, *PQSPR*, and *OIB* (data on index constituents are from the TRTH Speedguide, while common stocks are identified through Datastream).

		America				Asia				Europe/Africa			
		Brazil	Canada	Mexico	U.S.	Hong Kong	India	Japan	Malaysia	France	Germany	South Africa	U.K.
<i>RETURN</i>	Mean	-0.14	0.00	0.07	0.00	-0.04	-0.22	-0.09	-0.02	-0.02	-0.11	-0.02	-0.06
	Median	0.08	0.07	0.05	0.02	0.05	0.38	0.02	-0.08	0.05	0.04	0.08	0.05
	St.Dev.	14.98	6.61	9.46	10.06	12.82	13.42	9.73	6.60	10.19	11.69	7.28	8.32
<i>PQSPR</i>	Mean	0.29	0.25	0.41	0.11	0.30	0.09	0.28	0.82	0.14	0.13	0.52	0.25
	Median	0.24	0.22	0.35	0.06	0.36	0.07	0.24	0.81	0.10	0.09	0.48	0.14
	St.Dev.	0.19	0.14	0.23	0.08	0.13	0.05	0.10	0.29	0.09	0.11	0.24	0.21
<i>OIB</i>	Mean	0.01	0.01	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	-0.01	-0.16
	Median	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.04	-0.07
	St.Dev.	0.35	0.06	0.04	0.05	0.07	0.09	0.14	0.04	0.22	0.10	4.68	3.78
<i>TURNOVER</i>	Mean	0.38	0.23	0.13	0.26	0.23	0.40	0.48	0.09	0.40	0.35	16.54	20.20
	Median	0.22	0.20	0.11	0.23	0.19	0.33	0.41	0.07	0.25	0.29	14.17	16.52
	St.Dev.	0.60	0.13	0.07	0.11	0.16	0.26	0.31	0.07	0.46	0.24	10.89	14.81
# Obs.		109,855	283,435	142,564	273,375	135,049	174,064	162,352	230,477	366,343	321,979	277,452	369,445

Table IA.5: Spillovers in jumps in prices, liquidity, and trading activity across markets on the same day

This table presents the number of days on which one, two, or three markets within each region (America, Asia, and Europe/Africa and World) exhibit a jump in 5-minute value-weighted returns (*PRICE*), log-changes in value-weighted proportional quoted spreads (*PQSPR*), or value-weighted order imbalance (*OIB*) for 12 equity markets over 1996-2011. First, we use the BNS jump measure to identify days with jumps in each variable for each market. Then, we count the number of markets that have a jump of the same sign in the same variable on the same day, and distinguish between three cases: only one market has a jump in that variable on a certain day, two markets have a jump in that variable of the same-sign on the same day, and three or more markets have a jump in that variable of the same-sign on the same day. Jumps are classified according to their sign: positive (POS) and negative (NEG). We refer to the caption of Table 2 and to Appendix B for a detailed description of the jump statistics. Data are from TRTH, and Datastream.

		America		Asia		Europe / Africa		World	
		POS	NEG	POS	NEG	POS	NEG	POS	NEG
<i>PRICE</i>	= 1	371	374	724	737	767	578	1,223	1,198
	= 2	20	25	45	66	128	83	384	313
	≥ 3	3	1	1	1	25	31	107	93
<i>PQSPR</i>	= 1	131	73	502	569	260	160	762	726
	= 2	2	3	7	16	1	1	68	55
	≥ 3	-	-	-	-	-	-	5	2
<i>OIB</i>	= 1	616	490	687	637	875	937	1,382	1,394
	= 2	26	12	70	63	119	148	468	417
	≥ 3	-	-	2	3	12	15	107	104

Table IA.6: The frequency and magnitude of jumps in prices, liquidity, and trading activity: sub-period analysis

Panel A of this table shows the number of 5-minute intervals with a jump in value-weighted returns (*PRICE*), log-changes in value-weighted proportional quoted spreads (*PQSPR*), and value-weighted order imbalance (*OIB*) for 12 equity markets over two sub-periods: 1996-2006 and 2007-2011 (aggregated by region: America, Asia, Europe/Africa, and World). Panel B shows the corresponding mean and standard deviation of the absolute magnitude of the jump, measured in terms of jump-free standard deviations (that is, the square root of the scaled bipower variation). Panel C shows the mean and median of jumps in *PRICE* (in bps), *PQSPR*, and *OIB* (in bps) for positive and negative jumps, respectively. For the purpose of computing summary statistics in Panel B only, we winsorize jump sizes by region at 0.5% and 99.5% levels. We note that we use non-winsorized data for jump estimation. Jumps are identified using the BNS jump statistic that is based on the ratio of the bipower (continuous) variation to the squared variation of the intraday observations for each variable (see Appendix B for details). The jumps are classified according to their sign: positive (POS) and negative (NEG). Data to calculate these variables are from TRTH (trade and quote data) and Datastream (market capitalization data). Only common stocks that were ever part of the major local equity index are included in the computation of value-weighted returns, *PQSPR*, and *OIB* (data on index constituents are from the TRTH Speedguide, while common stocks are identified through Datastream).

		1996-2006				2007-2011			
		America	Asia	Europe / Africa	World	America	Asia	Europe / Africa	World
Panel A: Number of jumps									
<i>PRICE</i>	POS	274	698	885	1,857	170	186	277	633
	NEG	279	733	600	1,612	169	217	279	665
<i>PQSPR</i>	POS	49	300	205	554	92	232	68	392
	NEG	36	478	138	652	47	163	32	242
<i>OIB</i>	POS	498	638	907	2,043	227	241	313	781
	NEG	364	622	1,005	1,991	185	189	334	708
Panel B: Absolute magnitude of jumps (in jump-free standard deviations)									
<i>PRICE</i>	Mean	4.98	4.49	7.06	5.64	5.16	4.34	6.05	5.28
	St.Dev.	1.40	1.12	5.12	3.41	1.65	1.16	2.53	2.04
<i>PQSPR</i>	Mean	5.26	5.23	7.22	5.80	6.59	5.89	7.89	6.34
	St.Dev.	1.54	1.64	3.41	2.43	3.35	2.29	2.59	2.62
<i>OIB</i>	Mean	5.80	4.97	7.18	6.18	5.85	4.54	5.73	5.41
	St.Dev.	2.37	1.35	3.95	3.04	2.78	1.22	1.99	2.08

Table IA.6 (continued)

			Panel C: Magnitude of jumps							
			1996-2006				2007-2011			
			America	Asia	Europe / Africa	World	America	Asia	Europe / Africa	World
<i>PRICE</i>	POS	Mean	28.11	23.51	51.57	37.73	43.62	28.47	52.36	42.86
		Median	21.68	19.21	35.50	26.05	32.45	22.03	43.00	33.02
	NEG	Mean	-30.76	-24.02	-42.56	-32.02	-43.68	-30.18	-48.37	-41.32
		Median	-25.36	-20.68	-32.84	-25.45	-34.31	-26.01	-41.75	-32.87
<i>PQSPR</i>	POS	Mean	0.68	0.18	0.75	0.43	0.65	0.18	1.32	0.49
		Median	0.58	0.13	0.56	0.25	0.56	0.16	1.37	0.25
	NEG	Mean	-0.58	-0.16	-0.73	-0.30	-0.67	-0.17	-1.40	-0.43
		Median	-0.49	-0.14	-0.50	-0.17	-0.53	-0.15	-1.54	-0.20
<i>OIB</i>	POS	Mean	0.74	0.29	14.34	6.37	0.74	0.30	9.09	3.90
		Median	0.34	0.23	3.92	0.45	0.22	0.21	1.01	0.32
	NEG	Mean	-0.66	-0.29	-15.55	-8.01	-0.83	-0.26	-8.80	-4.38
		Median	-0.34	-0.24	-5.77	-0.50	-0.23	-0.18	-0.71	-0.33

Table IA.7: Coinciding jumps in prices, liquidity, and trading activity within a market: sub-period analysis

This table shows the number of *PQSPR* jumps (Panel A) and *OIB* jumps (Panel B) that occur on the same day (within/before/after that 5-minute interval) as price jumps for 12 equity markets over two sub-periods: 1996-2006 and 2007-2011. We treat either a positive or a negative price jump as an event and we count the number of 5-minute intervals with jumps in either *PQSPR* or *OIB* in the same interval as the event (i.e., simultaneously), before the event (that is, from the beginning of the same trading day – or from the previous price jump on the same day – till the event) and after the event (that is, from the event till the end of the same trading day – or till the next price jump). In each panel, the first two columns show the signs of the jumps in the variables under consideration. For example, the first column shows the sign of the price jumps (POS for positive jumps and NEG for negative jumps). In each panel, the first two rows show the number of positive or negative price jumps that are *not* associated with a jump in either *PQSPR* or *OIB* on the same market on the same day. The next four rows show the number of positive or negative price jumps that are accompanied by a positive or negative jump in either *PQSPR* or *OIB* on the same market in the same 5-minute interval. The following four rows show the number of positive or negative price jumps that were preceded by a positive or negative jump in either *PQSPR* or *OIB* on the same market on the same day. The final four rows show the number of positive or negative price jumps that were followed by a positive or negative jump in either *PQSPR* or *OIB* on the same market on the same day. We refer to the caption of Table 2 and to Appendix B for a detailed description of the jump statistics. Data are from TRTH and Datastream.

Panel A: Coinciding jumps in prices and *PQSPR*

	Sign of the jump in		1996-2006				2007-2011			
	<i>PRICE</i>	<i>PQSPR</i>	America	Asia	Europe / Africa	World	America	Asia	Europe / Africa	World
Jumps in <i>PRICE</i> with no jumps in <i>PQSPR</i> on the same day	POS	NA	269	579	827	1675	157	162	266	585
	NEG	NA	270	656	565	1491	160	199	273	632
Simultaneous jumps in <i>PRICE</i> and <i>PQSPR</i>	POS	POS	1	4	8	13	1	3	1	5
	POS	NEG	0	13	4	17	1	2	5	8
	NEG	POS	2	2	6	10	3	3	1	7
	NEG	NEG	1	6	4	11	1	2	0	3
Jumps in <i>PRICE</i> preceded by jump in <i>PQSPR</i> on same day	POS	POS	1	9	5	15	4	3	5	12
	POS	NEG	0	44	8	52	3	4	3	10
	NEG	POS	1	10	7	18	1	4	1	6
	NEG	NEG	2	27	4	33	0	1	1	2
Jumps in <i>PRICE</i> followed by jump in <i>PQSPR</i> on same day	POS	POS	1	16	21	38	3	7	0	10
	POS	NEG	2	25	25	52	3	1	0	4
	NEG	POS	1	11	7	19	2	7	3	12
	NEG	NEG	2	16	7	25	0	1	0	1

Table IA.7 (continued)
Panel B: Coinciding jumps in prices and *OIB*

	Sign of the jump in		1996-2006				2007-2011			
	<i>PRICE</i>	<i>OIB</i>	America	Asia	Europe / Africa	World	America	Asia	Europe / Africa	World
Jumps in <i>PRICE</i> with no jumps in <i>OIB</i> on the same day	POS	NA	234	537	625	1396	141	143	206	490
	NEG	NA	239	555	445	1239	140	152	206	498
Simultaneous jumps in <i>PRICE</i> and <i>OIB</i>	POS	POS	10	58	63	131	16	22	35	73
	POS	NEG	1	0	2	3	0	0	0	0
	NEG	POS	1	1	0	2	0	0	0	0
	NEG	NEG	8	76	45	129	12	37	38	87
Jumps in <i>PRICE</i> preceded by jump in <i>OIB</i> on same day	POS	POS	9	14	30	53	1	3	5	9
	POS	NEG	4	9	41	54	2	2	4	8
	NEG	POS	12	18	24	54	4	7	13	24
	NEG	NEG	2	12	18	32	0	3	6	9
Jumps in <i>PRICE</i> followed by jump in <i>OIB</i> on same day	POS	POS	12	37	66	115	6	11	10	27
	POS	NEG	7	27	74	108	2	4	11	17
	NEG	POS	13	25	21	59	8	16	4	28
	NEG	NEG	8	45	42	95	4	7	11	22

Table IA.8: Jumps in prices and macro announcements: sub-period analysis

This table presents the number of jumps in 5-minute value-weighted returns (*PRICE*) within each region (America, Asia, Europe/Africa, and World) that occur within a short event window around macro announcements over two sub-periods: 2001-2006 and 2007-2011. In total, we use data on 6,691 different macro announcements from the American region (Canada, U.S.), from the Asian region (China, Japan), and from the European region (EMU, France, Germany, U.K.). The event window around the macro announcements is $[-1, +12]$ measured in 5-minute intervals, respectively. We study global macro announcements (Panel A), regional macro announcements (Panel B), and U.S. macro announcements (Panel C). In addition, we report the p -value of a test of the hypothesis that the empirically observed number of jumps in *PRICE* around macro announcements is smaller or equal to the expected number under the assumption that jumps in *PRICE* and macro announcements are independent of each other. ***, **, * indicate statistical significance at 1%, 5%, and 10% levels, respectively. We refer to the caption of Table 2 and to Appendix B for a detailed description of the jump statistics. Data are from TRTH and Datastream. Data on the macro announcements are from the Econoday database.

	2001-2006				2007-2011			
	America	Asia	Europe / Africa	World	America	Asia	Europe / Africa	World
# <i>PRICE</i> jumps	344	1,013	983	2,340	339	403	556	1,298
Panel A: Global macro announcements								
# <i>PRICE</i> jumps around global macro announcements	58	42	279	379	66	25	204	295
p -value (<i>PRICE</i> jumps independent of global macro announcements)	0.00***	0.99	0.00***	0.00***	0.00***	0.98	0.00***	0.00***
Panel B: Regional macro announcements								
# <i>PRICE</i> jumps around regional macro announcements	56	2	55	113	66	4	36	106
p -value (<i>PRICE</i> jumps independent of regional macro announcements)	0.00***	0.71	0.98	0.47	0.00***	0.62	1.00	0.38
Panel C: U.S. macro announcements								
# <i>PRICE</i> jumps around U.S. macro announcements	56	-	225	281	66	-	162	228
p -value (<i>PRICE</i> jumps independent of U.S. macro announcements)	0.00***	-	0.00***	0.00***	0.00***	-	0.00***	0.00***

Figure IA.1: Behavior of prices, $PQSPR$ and OIB around price jumps: 15-minute frequency

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative jumps in prices (averaged across all the price jumps in the 12 stock markets over 1996-2006). Panel A and Panel B present cumulative average returns around all price jumps in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around positive and negative price jumps in our sample. Panel E and Panel F present average OIB around positive and negative price jumps in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 15-minute interval in the event window, with the price jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

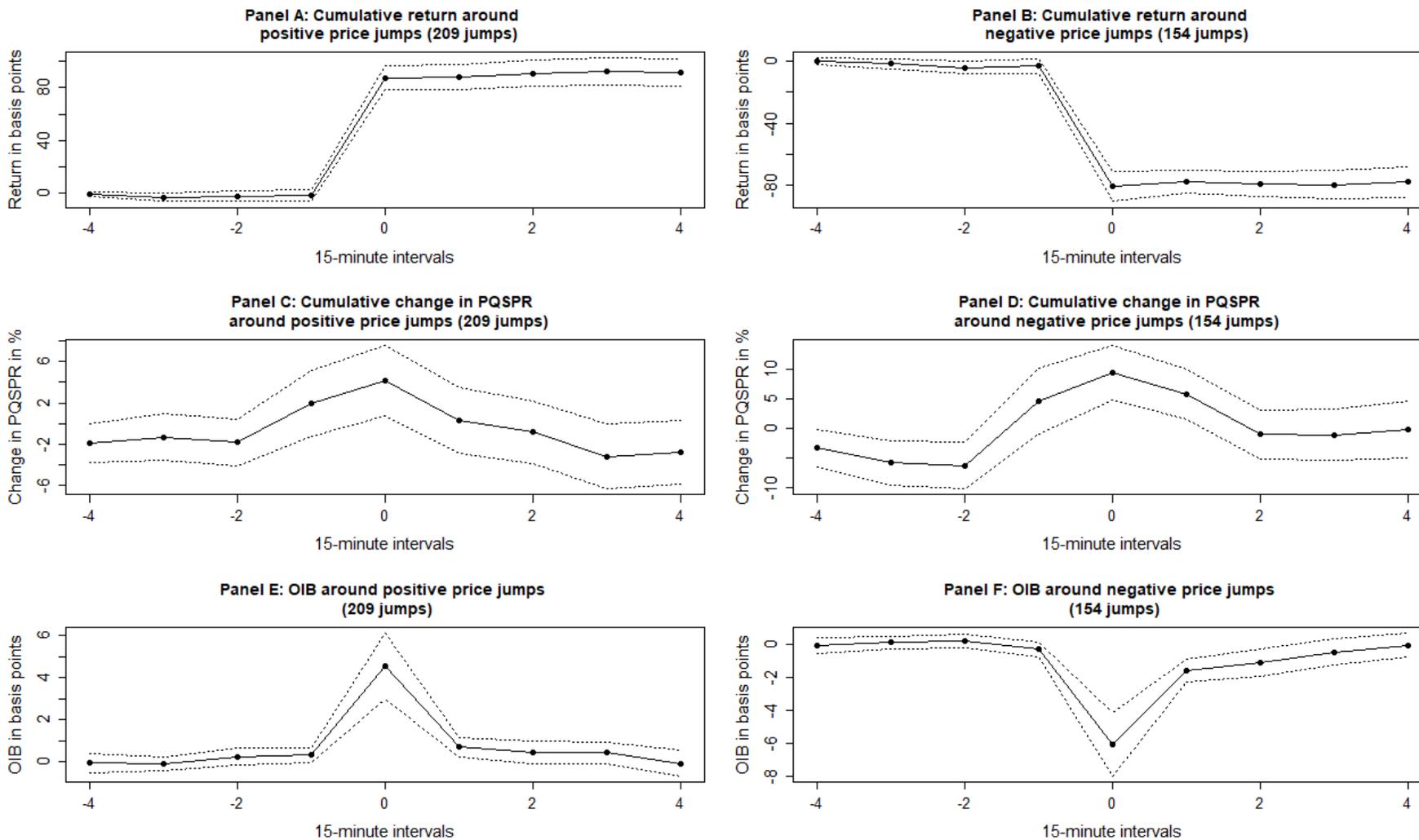


Figure IA.2: Behavior of prices, $PQSPR$ and OIB around price jumps: 1-hour frequency

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative jumps in prices (averaged across all the price jumps in the 12 stock markets over 1996-2006). Panel A and Panel B present cumulative average returns around all price jumps in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around positive and negative price jumps in our sample. Panel E and Panel F present average OIB around positive and negative price jumps in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 1-hour interval in the event window, with the price jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

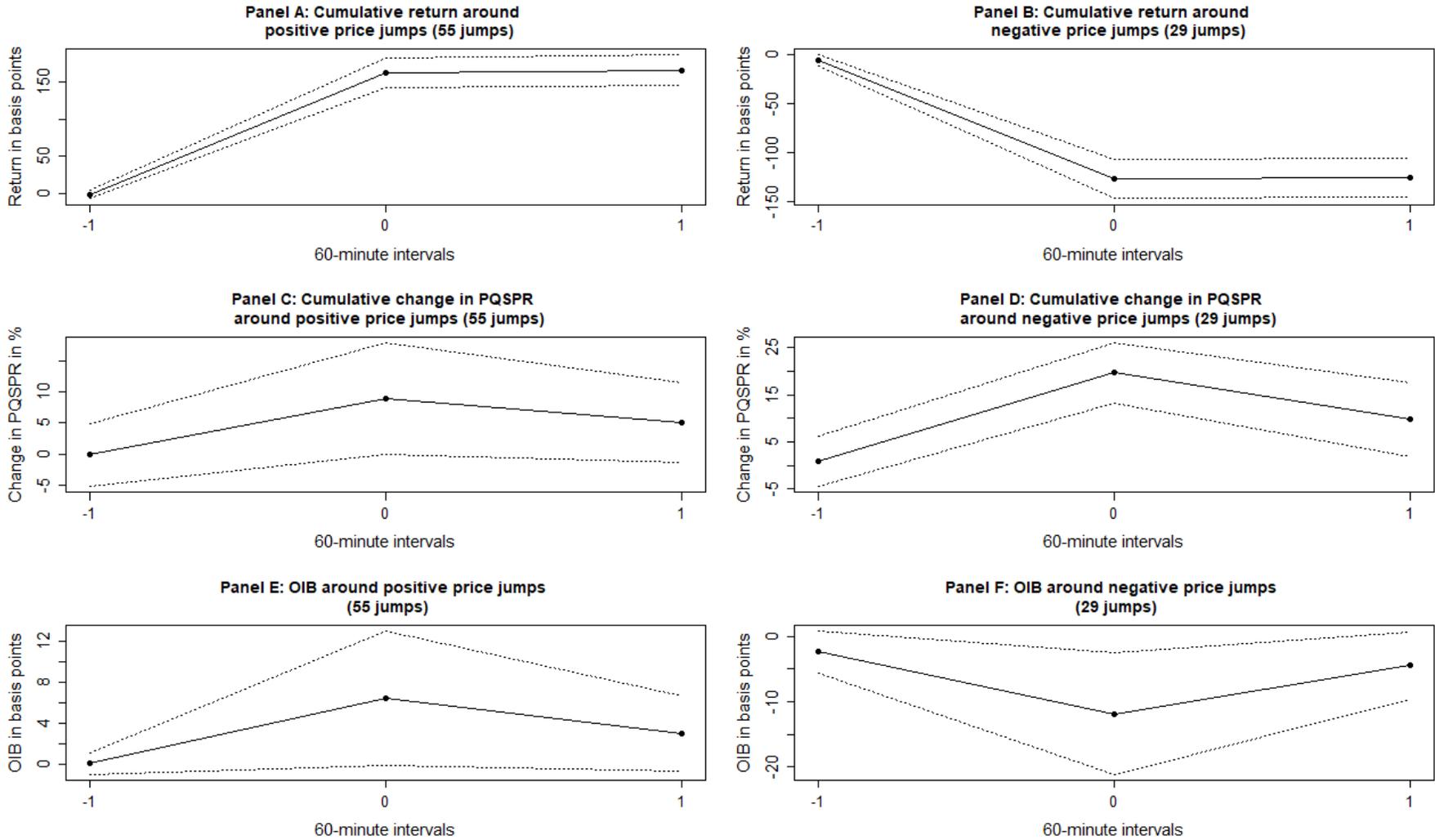


Figure IA.3: Behavior of prices, $PQSPR$ and OIB around price jumps that coincide with same-sign jumps in OIB

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative jumps in prices that coincide with the same-sign jump in OIB (averaged across all the price jumps in the 12 stock markets over 1996-2011). Panel A and Panel B present cumulative average returns around all price jumps that coincide with the same-sign jump in OIB in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around all price jumps that coincide with the same-sign jump in OIB in our sample. Panel E and Panel F present average OIB around all price jumps that coincide with the same-sign jump in OIB in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 5-minute interval in the event window, with the price jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

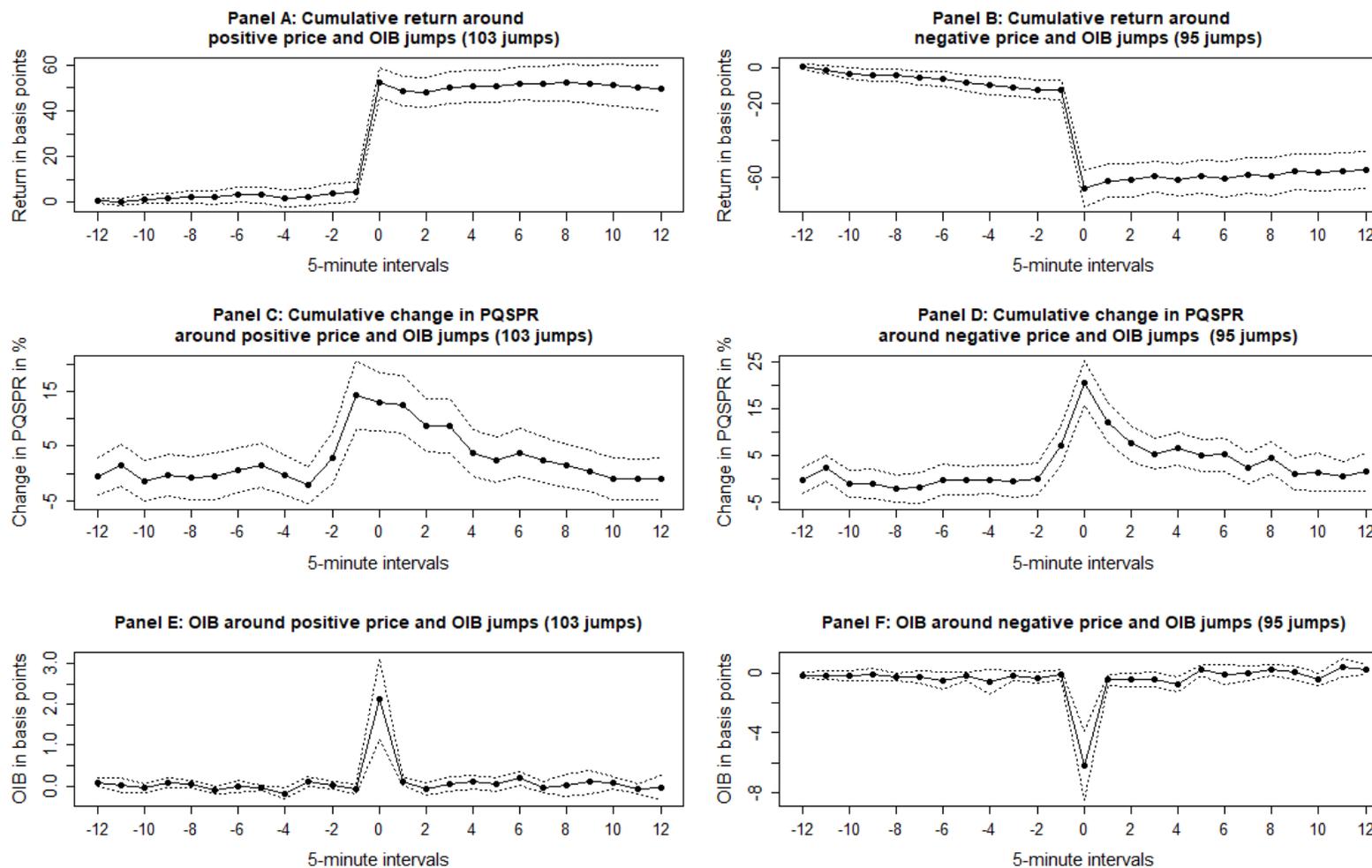


Figure IA.4: Behavior of prices, $PQSPR$ and OIB around price jumps that do not coincide with macro announcements

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative jumps in prices that do not coincide with macro announcements (averaged across all the price jumps in the 12 stock markets over 2001-2011). Panel A and Panel B present cumulative average returns around all price jumps that do not coincide with macro announcements in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around all price jumps that do not coincide with macro announcements in our sample. Panel E and Panel F present average OIB around all price jumps that do not coincide with macro announcements in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 5-minute interval in the event window, with the price jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

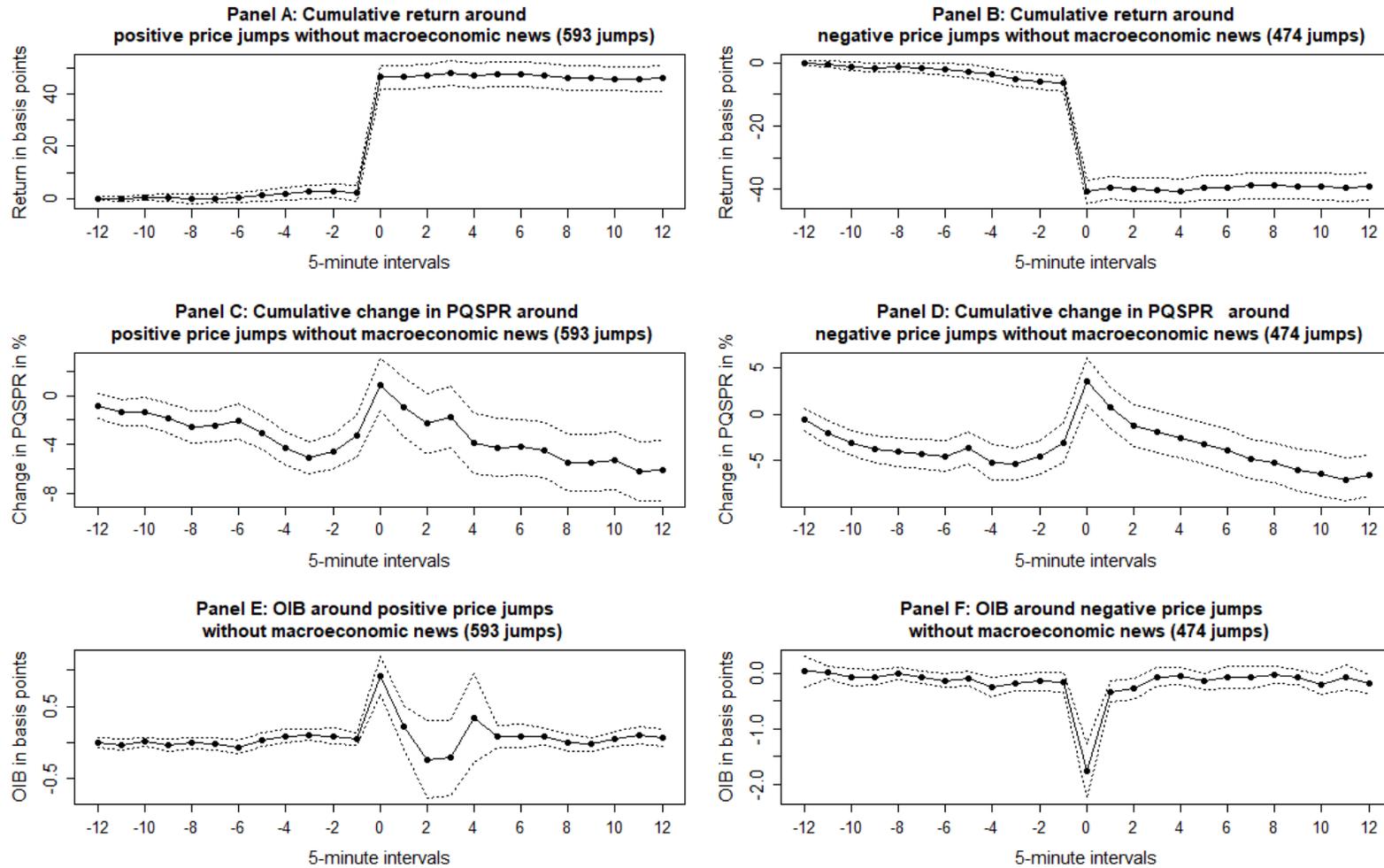


Figure IA.5: Behavior of prices, $PQSPR$ and OIB around transitory price jumps

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative transitory jumps in prices (averaged across all the price jumps in the 12 stock markets over 1996-2011). Transitory jumps in price are defined as jumps in price that revert by more than $2/3$ by the end of one hour. Panel A and Panel B present cumulative average returns around all transitory price jumps in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around all transitory price jumps in our sample. Panel E and Panel F present average OIB around all transitory price jumps in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 5-minute interval in the event window, with the price jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

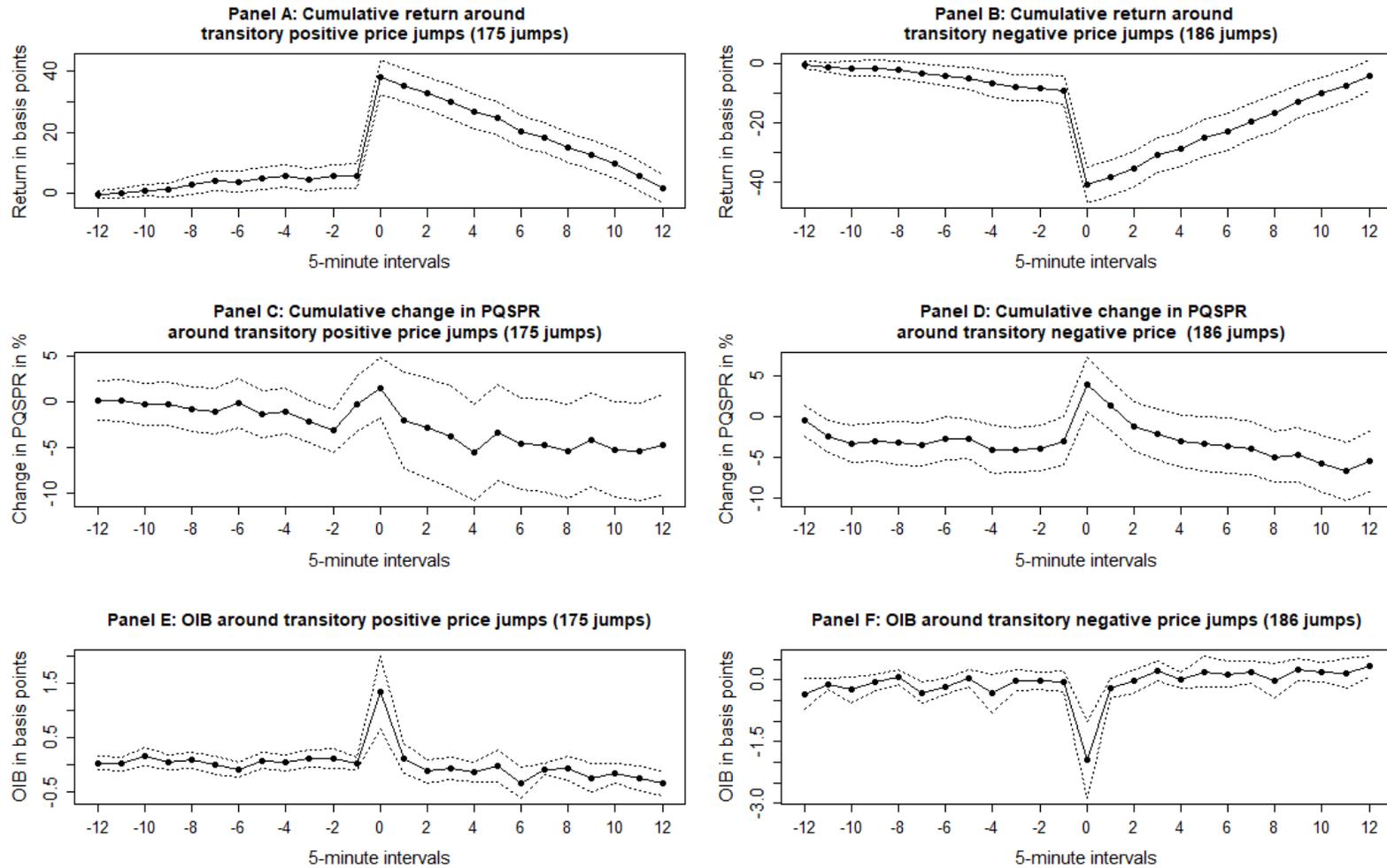


Figure IA.6: Behavior of prices, $PQSPR$ and OIB around $PQSPR$ jumps

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative jumps in $PQSPR$ (averaged across all the $PQSPR$ jumps in the 12 stock markets over 1996-2011). Panel A and Panel B present cumulative average returns around positive and negative $PQSPR$ jumps in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around positive and negative $PQSPR$ jumps in our sample. Panel E and Panel F present average OIB around positive and negative $PQSPR$ jumps in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 5-minute interval in the event window, with the $PQSPR$ jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

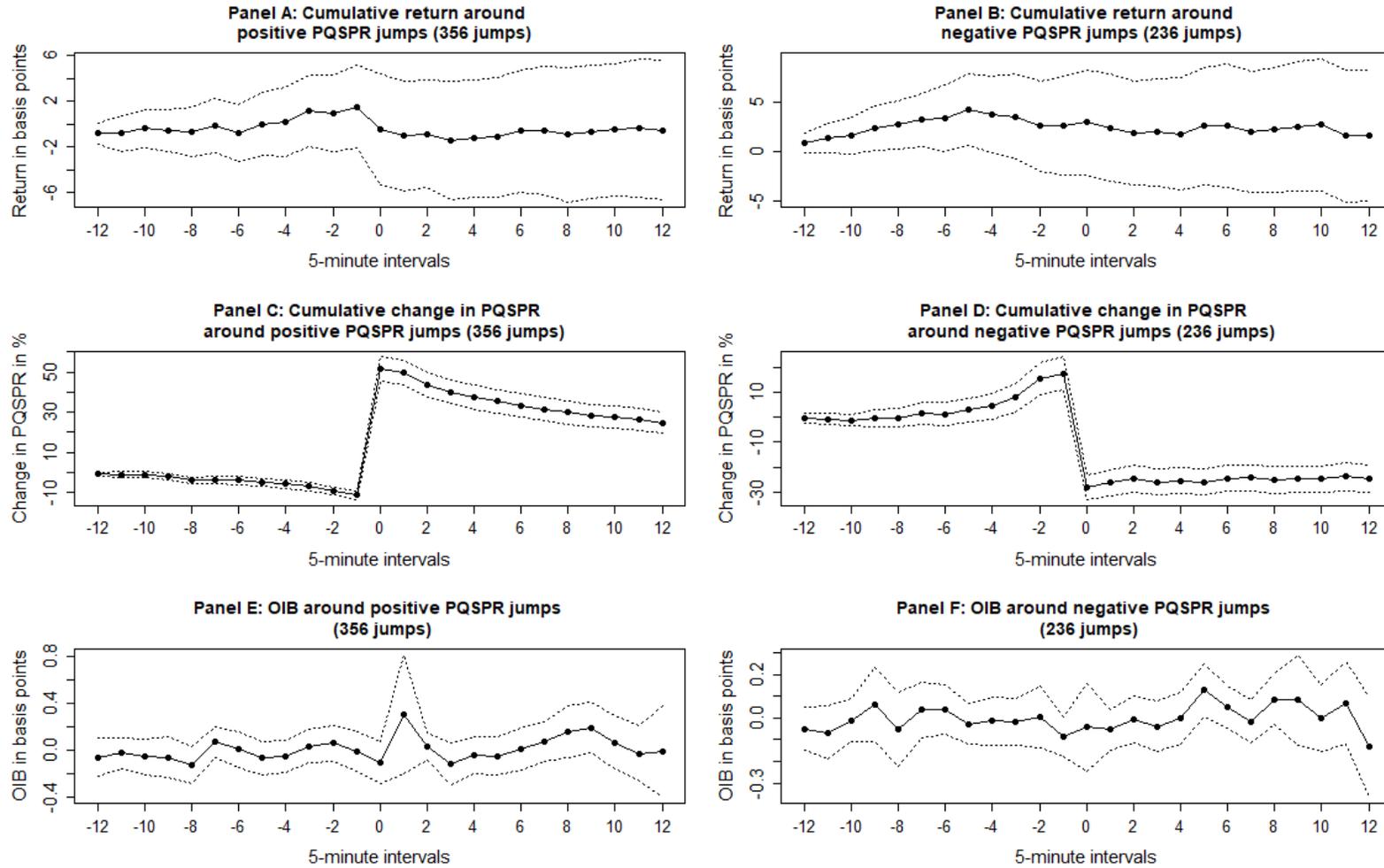


Figure IA.7: Behavior of prices, $PQSPR$ and OIB around OIB jumps

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative jumps in OIB (averaged across all the OIB jumps in the 12 stock markets over 1996-2011). Panel A and Panel B present cumulative average returns around positive and negative OIB jumps in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around positive and negative OIB jumps in our sample. Panel E and Panel F present average OIB around positive and negative OIB jumps in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 5-minute interval in the event window, with the OIB jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

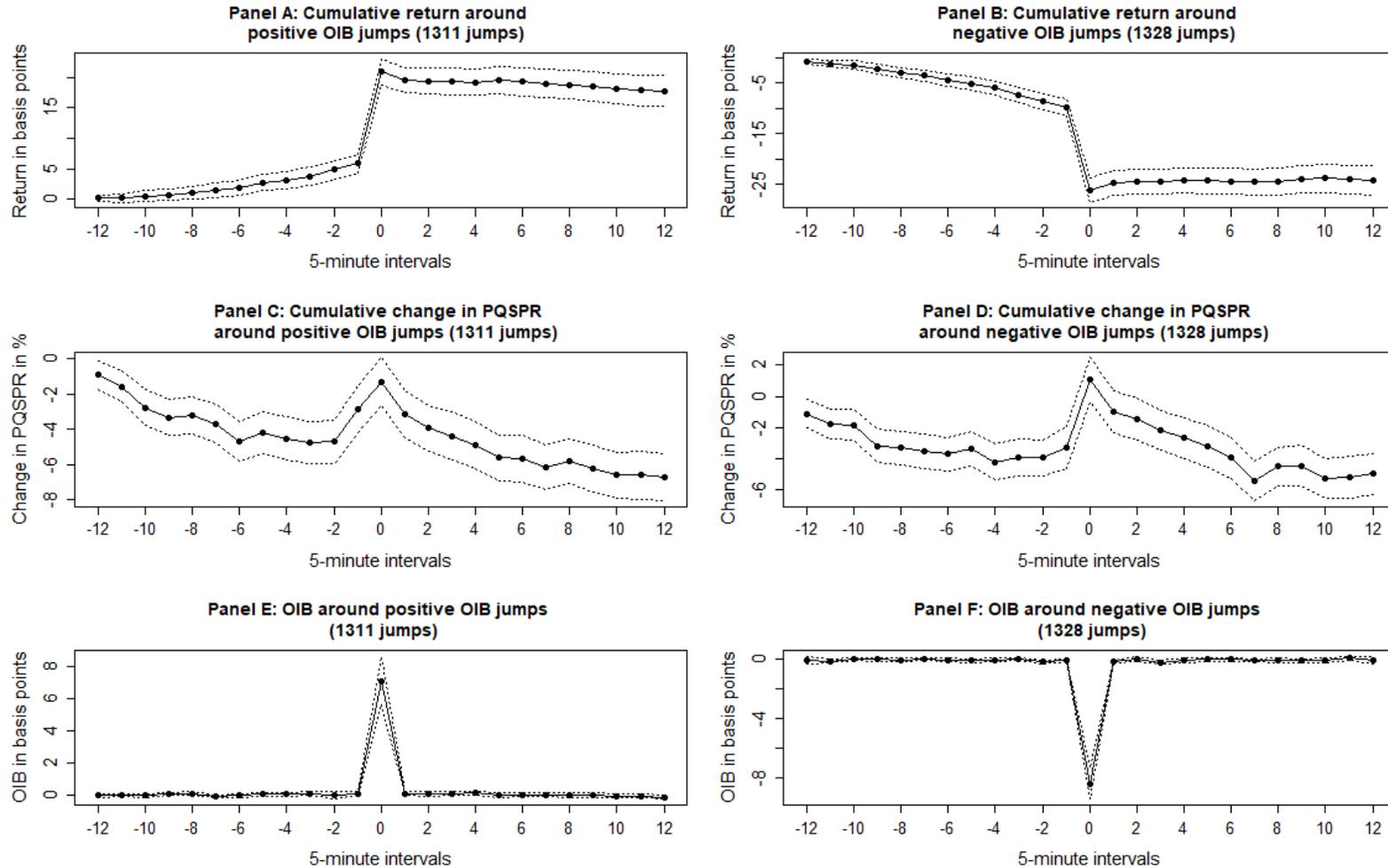


Figure IA.8: Behavior of prices, $PQSPR$ and OIB around price jumps: 1996-2006

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative jumps in prices (averaged across all the price jumps in the 12 stock markets over 1996-2006). Panel A and Panel B present cumulative average returns around all price jumps in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around positive and negative price jumps in our sample. Panel E and Panel F present average OIB around positive and negative price jumps in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 5-minute interval in the event window, with the price jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

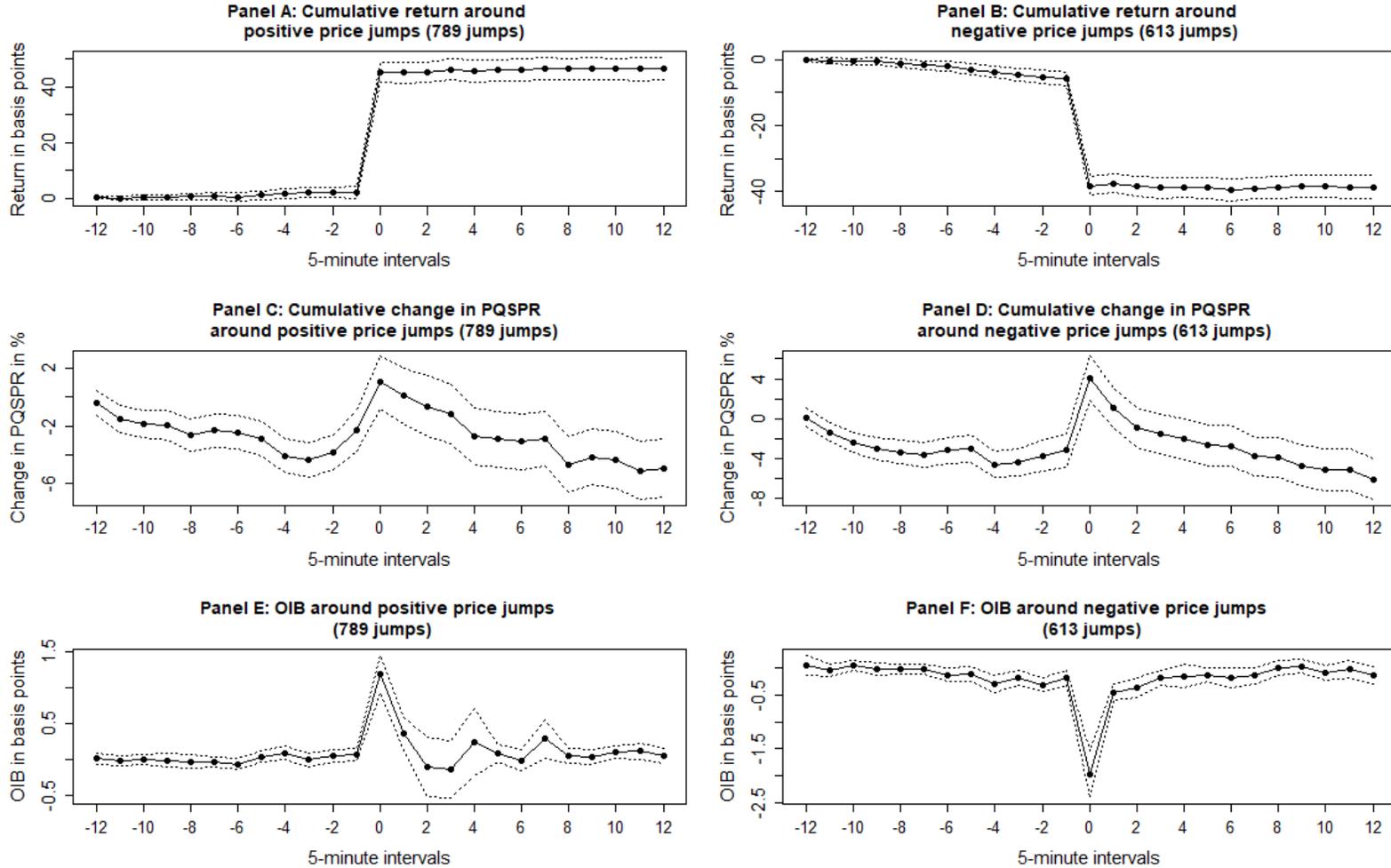


Figure IA.9: Behavior of prices, $PQSPR$ and OIB around price jumps: 2007-2011

This figure shows the behavior of prices, $PQSPR$ and OIB from one hour before till one hour after either positive or negative jumps in prices (averaged across all the price jumps in the 12 stock markets over 2007-2011). Panel A and Panel B present cumulative average returns around all price jumps in our sample. Panel C and Panel D present average cumulative changes in $PQSPR$ around positive and negative price jumps in our sample. Panel E and Panel F present average OIB around positive and negative price jumps in our sample. Dashed lines represent 95% confidence intervals. Cumulative returns, cumulative changes in $PQSPR$ and OIB are plotted for each 5-minute interval in the event window, with the price jump taking place at $t = 0$. We include only jump events without missing observations in the event window. Jumps are identified using BNS jump measure.

