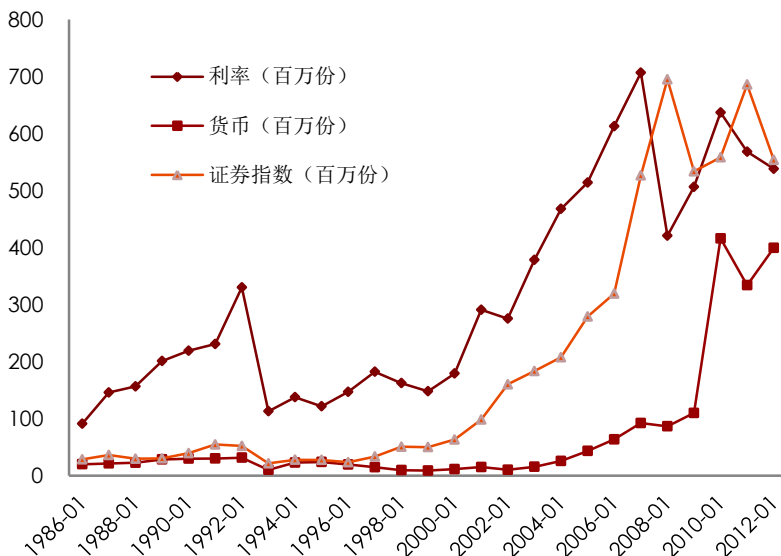




Intraday Volatility Spillovers between Index Futures and Spot Market: Evidence from China

Zhou Zhou, Huiyan Dong, Shouyang Wang

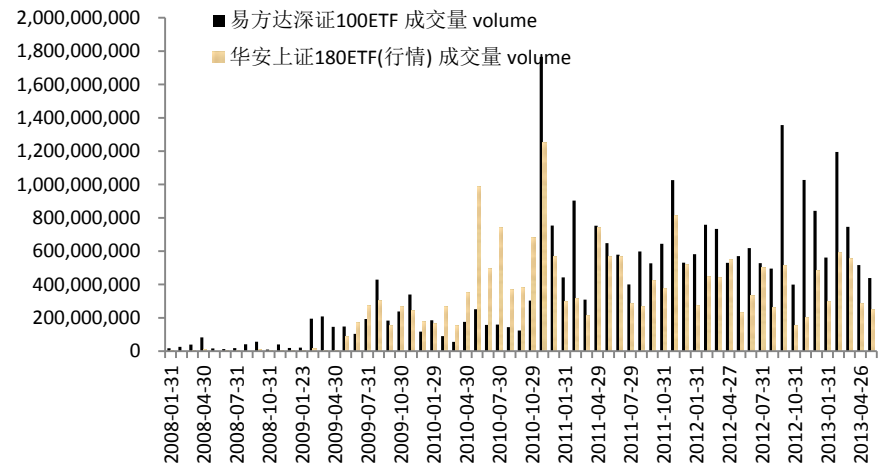
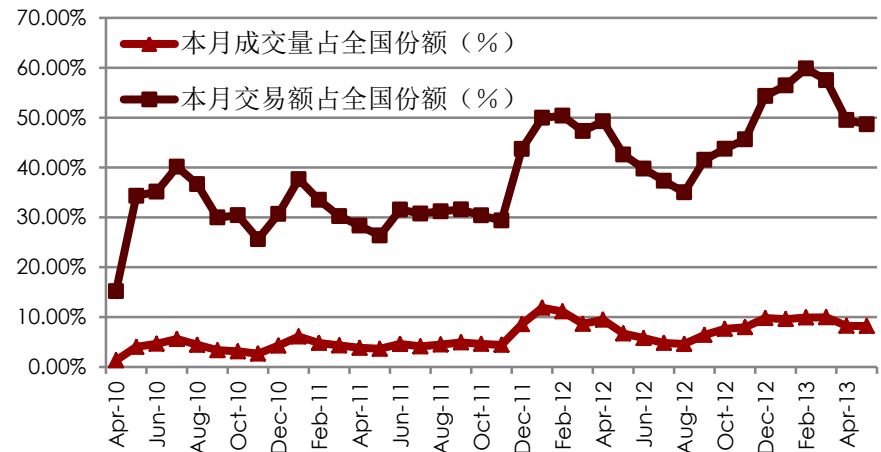
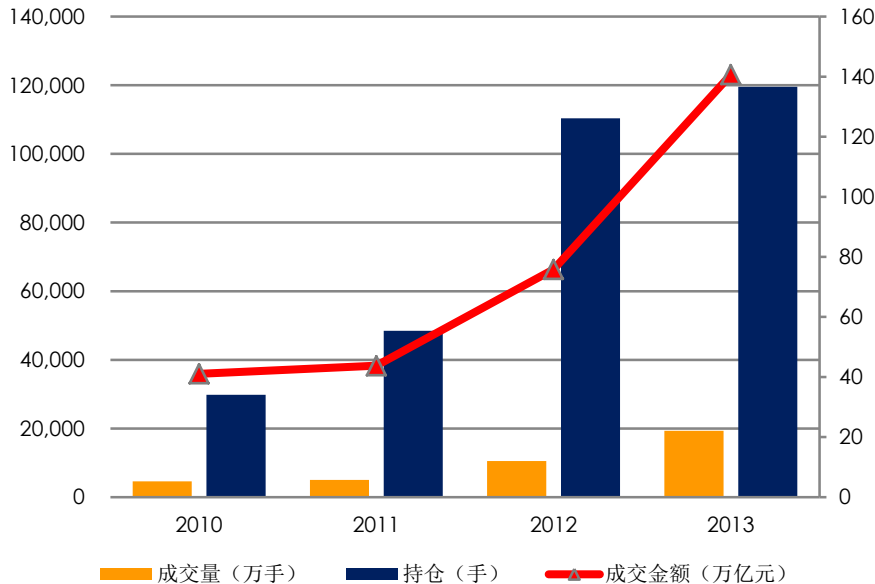
Introduction



The Crash of October 1987 in the US stock market and its impact on other stock markets overall have motivated the growth of academic researches on the transmission of volatility across different markets.

Introduction

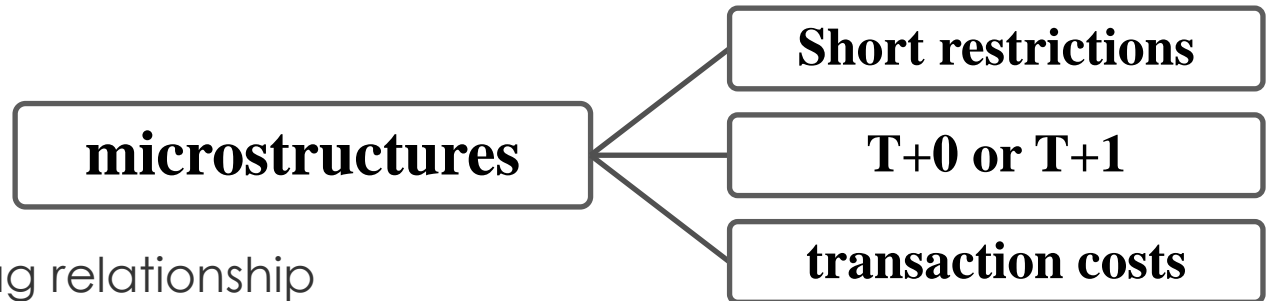
The first index future in china was listed in April 16th



Introduction



- Efficient market hypothesis:
 - efficient market should response simultaneously to any new information
- In reality
 - different market microstructures



- Produce lead-lag relationship
- Understanding volatility spillover is important for **predicting future volatilities** in both markets

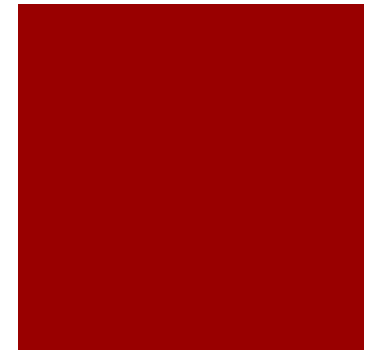
Introduction



Researches	
<ul style="list-style-type: none">Futures markets play a more important role on volatility spillover<ul style="list-style-type: none">lower transaction costslower margins	Zhong et al. (2004) Chatrath et al. (1999) Lien and Tse (2002) Darrat and Rahman (2005) Pericli and Koutmos (2007)
<ul style="list-style-type: none">Bi-directional volatility spillover	Liu et al. (2008) Chan and Karolyi (2001) Min and Najand (2009) Lin et al. (2002) So and Tse (2004)
<ul style="list-style-type: none">No volatility spillover	Kawaller et al. (2000) Arshanapalli and Doukas(2004)

Introduction

- Realized volatility
 - better proxy for volatility under the high frequency circumstances
- TVP-VAR model
 - provide time varying relationship among different markets
- Factors that influence the volatility spillover
 - News announcements



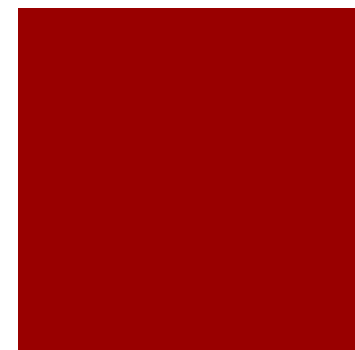
Data and statistics

- One-minute data
 - August 23, 2010 to June 21, 2013, 681 trading days
 - trading time: 9:30-11:29 am and 13:00-14:59 pm, 163,440 minutes
- The 240 minutes on each trading day were divided into four sub-intervals
- Calculated the realized volatility within each sub-interval

$$r(t, \Delta) = |p(t + \Delta) - p(t)|$$

$$\sigma_{t, \Delta}^2 = \sum_{j=1}^{1/\Delta} r_{t-1+j\Delta, \Delta}^2$$

Data and statistics



	Futures		Spot	
	RV	Δ RV	RV	Δ RV
Panel A: Descriptive statistics				
Observation	2724	2723	2724	2723
Mean	3.90E-05	-7.75E-09	2.44E-05	1.64E-09
Max	0.000835	0.000782	0.000939	0.000918
Min	5.36E-07	-0.000738	1.56E-06	-0.000920
Skewness	7.102130	0.628486	9.948980	0.165785
Kurtosis	75.41066	49.02570	140.6173	74.71264
Jarque-B	618014.8**	240525.4**	2194459**	583494.9**
Panel B: Results of unit root tests				
ADF	-6.920091**	-18.40772**	-10.10731**	-18.30215**
PP	-56.57999**	-246.7157**	-56.71559**	-338.3654**

** indicates the rejection of the null hypothesis at the 1% level of significance

Data and statistics

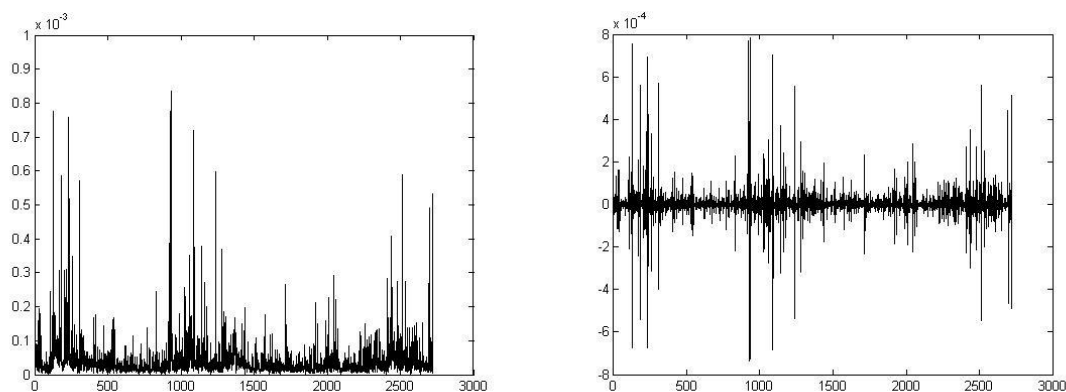


Fig. 1. (a) realized volatility of index future; (b) change of realized volatility of index future

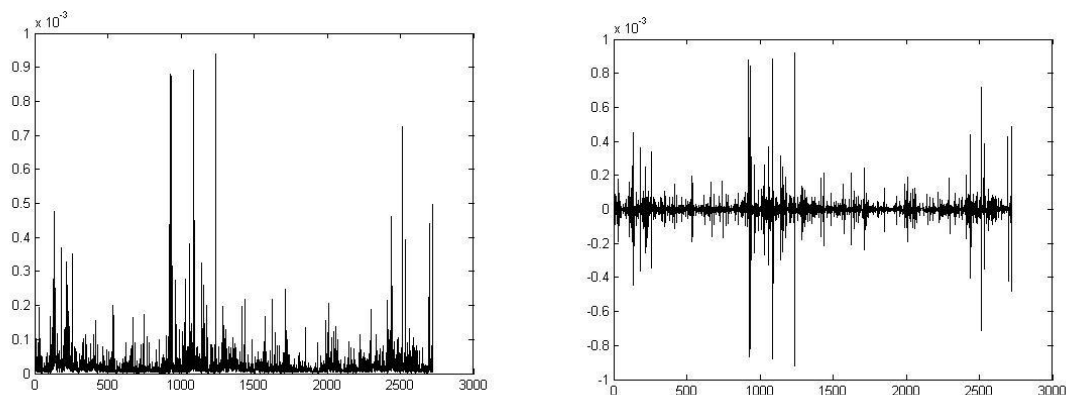


Fig. 2. (a) realized volatility of spot; (b) change of realized volatility of spot

Data and statistics

■ Scheduled news released:

- Growth: 6 (GDP/profit/invest/power consumption/consumption)
- Monetary policy:2 (M2/loan)
- Price:2 (CPI/PPT)
- Investigation index: (PMI/HSBC PMI)

■ Unscheduled news released

- Reserve rate
- Interest rate

发布日期	时间	内容
2012/7/5	19:00:00	下调金融机构人民币存贷款基准利率0.25个百分点
2012/6/7	19:00:00	下调金融机构人民币存贷款基准利率0.25个百分点
2011/7/6	18:32:12	上调金融机构人民币存贷款基准利率0.25个百分点
2011/4/5	18:00:14	上调金融机构人民币存贷款基准利率0.25个百分点
2011/2/8	18:30:30	上调金融机构人民币存贷款基准利率0.25个百分点
2010/12/25	17:35:21	上调金融机构人民币存贷款基准利率0.25个百分点
2010/10/19	18:59:36	上调金融机构人民币存贷款基准利率0.25个百分点

公布日期	公布时间	执行日期	内容
2012/5/12	19:00:00	2012/5/18	下调金融机构人民币存款准备金率0.5个百分点
2012/2/18	20:00:00	2012/2/24	下调金融机构人民币存款准备金率0.5个百分点
2011/11/30	19:03:42	2011/12/5	下调金融机构人民币存款准备金率0.5个百分点
2011/6/14	15:18:25	2011/6/20	上调存款类金融机构人民币存款准备金率0.5个百分点
2011/5/12	18:30:02	2011/5/18	上调金融机构人民币存款准备金率0.5个百分点
2011/4/17	17:02:15	2011/4/21	上调存款类金融机构人民币存款准备金率0.5个百分点
2011/3/18	18:20:56	2011/3/25	上调存款类金融机构人民币存款准备金率0.5个百分点
2011/2/18	18:02:18	2011/2/24	上调存款类金融机构人民币存款准备金率0.5个百分点
2011/1/14	17:55:26	2011/1/20	上调存款类金融机构人民币存款准备金率0.5个百分点
2010/12/10	18:00:01	2010/12/20	上调存款类金融机构人民币存款准备金率0.5个百分点
2010/11/19	17:59:46	2010/11/29	上调存款类金融机构人民币存款准备金率0.5个百分点
2010/11/10	18:45:00	2010/11/16	上调存款类金融机构人民币存款准备金率0.5个百分点

Data and statistics



指标名称	8:32	9:00	9:30	9:45	10:00	10:23	10:30	11:00	11:30	13:00	13:30	15:00	15:05	15:30	16:00	16:02	16:05	17:00	总计
CPI: 同比 (%)			23		10					1									34
GDP: 当季同比 (%)					11														11
M2: 同比 (%)	1	1			13					1		2	4		8	1	1	2	34
PMI		34																	34
PPI: 同比 (%)			23		10					1									34
工业企业利润: 累计同比 (%)			14		13														27
工业增加值: 同比 (%)					18					11				1					30
固定资产投资: 累计同比 (%)					18					12				1					31
汇丰PMI				8			26												34
汇丰PMI (预览)				9			20												29
贸易顺差 (亿美元)					8	1	1	2	22										34
全社会用电量: 累计同比 (%)		1						30											31
社会消费品零售总额: 同比 (%)					18					11				1					30
新增人民币贷款 (亿元)	1	1			16					1		1	4	1	6		1	2	34
总计	2	37	60	17	135	1	47	32	22	2	36	3	8	4	14	1	2	4	427

Methodology

- TVP-VAR Model

- time varying coefficients: capture nonlinearities relationship
- time varying covariance matrix of the additive innovations: capture possible heteroscedastic of the shocks

- SVAR:

$$A y_t = F_1 y_{t-1} + \dots + F_s y_{t-s} + u_t \quad \rightarrow \quad y_t = B_1 y_{t-1} + \dots + B_s y_{t-s} + A^{-1} \Sigma \varepsilon_t, \quad \varepsilon_t \sim N(0, I_k)$$

$$u_t \sim N(0, \Sigma \Sigma) \quad \Sigma = \begin{pmatrix} \sigma_1 & 0 & \dots & 0 \\ 0 & \sigma_2 & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \dots & 0 & \sigma_n \end{pmatrix}$$

$$A_t = \begin{pmatrix} 1 & 0 & \dots & 0 \\ a_{21} & 1 & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{k1} & \dots & a_{k,k-1} & 1 \end{pmatrix}$$

Methodology

$$y_t = X_t \beta_t + A_t^{-1} \Sigma_t \varepsilon_t, \quad t = s+1, \dots, n,$$

$$\beta_{t+1} = \beta_t + \mu_{\beta t}$$

$$\alpha_{t+1} = \alpha_t + \mu_{\alpha t}$$

$$h_{t+1} = h_t + \mu_{h t}$$

$$\begin{pmatrix} \varepsilon_t \\ \mu_{\beta t} \\ \mu_{\alpha t} \\ \mu_{h t} \end{pmatrix} \sim N \left(0, \begin{pmatrix} I_n & 0 & 0 & 0 \\ 0 & \Sigma_\beta & 0 & 0 \\ 0 & 0 & \Sigma_\alpha & 0 \\ 0 & 0 & 0 & \Sigma_h \end{pmatrix} \right)$$

- Estimation:
 - Bayesian methods
 - MCMC

Empirical results

- VAR (2) 模型

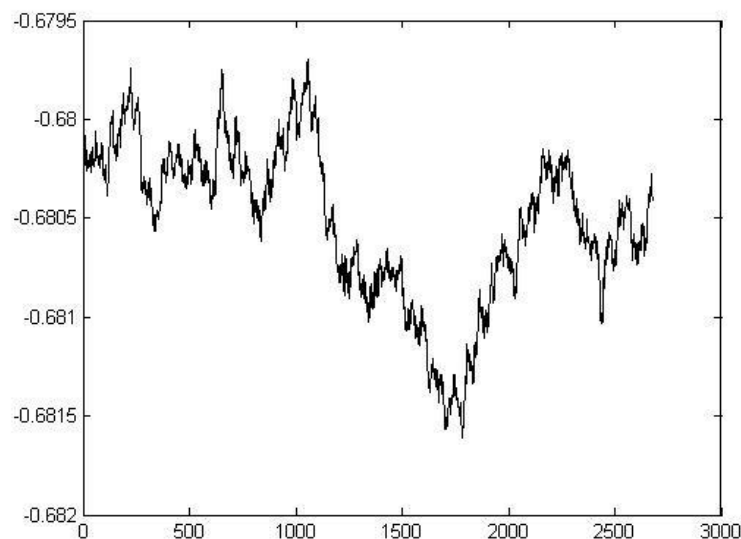
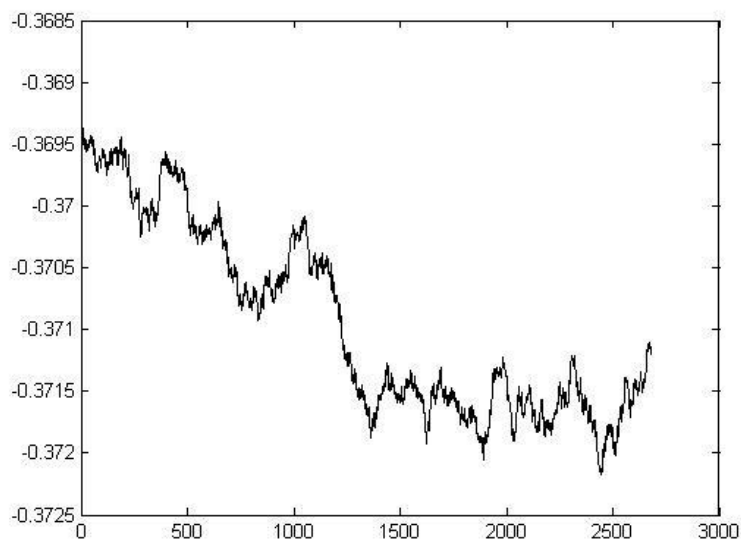
$$\Delta RV_t = C + \Omega \Delta RV_{t-1} + \Phi \Delta RV_{t-2} + \varepsilon_t$$

	D (CSI_RV_HOUR)	D (IF_RV_HOUR)
D (CSI_RV_HOUR (-1))	-0.633755 [-19.4829]**	0.050969 [1.52933]
D (IF_RV_HOUR (-1))	-0.017043 [-0.53634]	-0.643225 [-19.7568]**
D (CSI_RV_HOUR (-2))	-0.259111 [-7.98020]**	0.068602 [2.06220]**
D (IF_RV_HOUR (-2))	-0.103319 [-3.26563]**	-0.402775 [-12.4254]**
C	4.70E-09 [0.00407]	-4.42E-09 [-0.00374]
Adj. R-squared	0.325296	0.2958
F-statistic	328.8492	286.6348
Log likelihood	22582.71	22516.69
Log likelihood	46682.9	

- Bidirectional volatility spillover
- The volatility of the stock index futures market brings down the volatility of the stock market

Empirical results

- Primiceri (2005) MATLAB code
 - draw 10000 samples after the initial 5000 samples are discarded



- Since Sept, 2011, the effect enlarged——More institutional investors

Empirical results

$$\Delta RV_t = C + \Omega \Delta RV_{t-1} + (\Phi + \alpha A_1 + \beta A_2) \Delta RV_{t-2} + \varepsilon_t$$

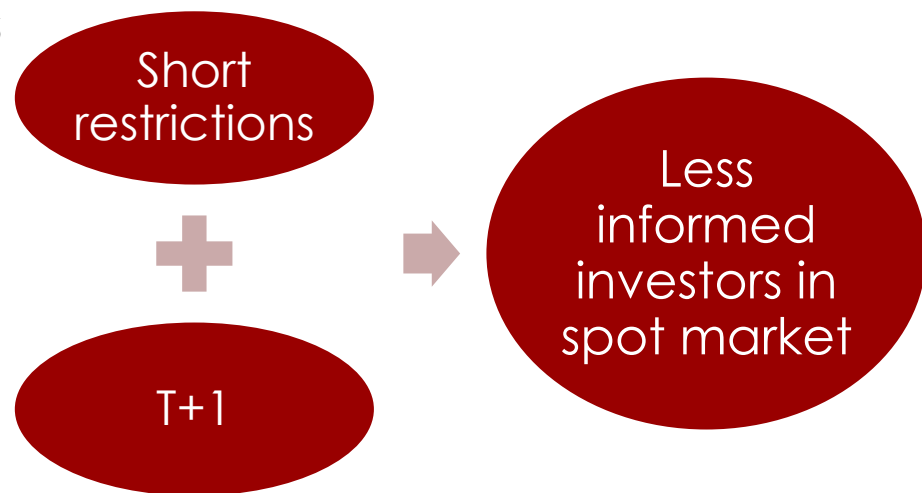


	D (CSI_RV_HOUR)	D (IF_RV_HOUR)
D (CSI_RV_HOUR (-1))	-0.648863	0.037108
	[-20.7997]	[1.15427]
D (IF_RV_HOUR (-1))	-0.000388	-0.628162
	[-0.01273]	[-20.0198]
D (CSI_RV_HOUR (-2))	-0.284531	0.044359
	[-9.09864]	[1.37647]
D (IF_RV_HOUR (-2))	-0.056052	-0.360648
	[-1.83044]	[-11.4284]
D (CSI_RV_HOUR (-2)) *A1	0.0485	0.082129
	[0.24389]	[0.40077]
D (IF_RV_HOUR (-2)) *A1	-1.190095	-1.00045
	[-6.72564]**	[-5.48632]**
D (CSI_RV_HOUR (-2)) *A2	9.896009	12.27748
	[5.67553]**	[6.83266]**
D (IF_RV_HOUR (-2)) *A2	-9.965644	-10.84732
	[-10.9563]**	[-11.5722]**

- The news released affect the size of the volatility spillover, both the scheduled and nonscheduled information.
- The volatility spillover between this two market are mostly taken by the news released

Conclusions and Discussions

- C1: bi-directional volatility spillovers
 - New information is almost reflected in spot and futures markets simultaneously
- C2: futures' volatility decrease the change of spot market's volatility
 - risk management function
 - In theory: more informed investors



Conclusions and Discussions

- C3: the influence of futures market on spot market enlarged as time passed, especially at the third quarter of 2011

- In reality: more informed investors

Mutual Fund

- Time lag: Nanfang Xiaokang ETF was listed in the first quarter in 2012

QDII

- 2011年5月 《合格境外机构投资者参与股指期货交易指引》

Trust Company

- 2011年7月 《信托公司参与股指期货交易业务指引》 出台

- C4: The volatility spillover between this two market are mostly taken by the news released



Thanks!