

)

2

C - F
] 4
3 n c
7 V %
W 4 S
? @ A
N O r
d 4
H J C
) L M
DC 0.16

! " # \$ % &
D E F G H I J K
^ J _ E F a b *
u v X w x y ? z {
5 6 7 0 Z 1 A
= # \$ > ? - g h i
* + * , i n o " P
_ c d 7 ' Z a b 0
F * G H J , i Q <
v w x 8 * c ~] 7
\$ E F G % * # j 8
* + u 2) K * * 1

? @ A B C - < \
. J ? . @ Manfred Kren
3 4 * F @ G H I 7 7 8

T U) V W X 5

< = # \$ v w
(D Z [* B C
y h 7 ^ 3 9 Y
s t f u 9 Q
"! "# \$ % + , - .
9 7 f y W
E F # # &
) * B C f
, ' 0
D 1 2 * 7
F , . < 1
? Q *)
| r 0 H
A v @ T
X 7 m T
d 9 *)
T j k 7 9 d

> ?? @ T p
* v w X r * +
\$ \$ v w w f
Y > L M @ # \$
~ + , _ '
*) # X) _ '
" (# # y ?
o @ _ 1 #
9 < = 0 * * 9
y ? . / 0 * +
* ~ h & T 5 6 * +
4 ' 7 ~ ! & T 9
\$ y ? * * ~ D 6 >
l A D # \$ y ? * Y
m B " 4 0 4 / C j m
~ h 7 ? " n 1 V 6 1 W
y ? * 4 V 6 4 W m B 7
\$ < = * I J
2 & | Z \$ D # \$ y
! 7 Q v 9 c 9 u 2
S 9 M ' < = 0 * +
E F 7 v b 5 X E #
4 ! " # \$ % &

st1YEF#\$%&0*sD12*~Z7')9#\$y?[r*,\;1L|0rwsWXEF,gEA*<=0*+"

"d# # \$vwB!

mo]*7o@-K)9*Ce)9\$D#\$EF*^_, '!{7?"0|r0*#jc90Zab*\$#\$vw%B!7'up#\$EF*vw~jeabXws"# \$vwB!j1xyijV*<=0vwYZ7ocV'? "nxy<=0#\$vw*Z[h97j1fu2d&bLMu2oTXUE*|yVW'X"~!7,. *34aDz{\$)*#\$EF>?AefTF*#\$EFh9"89o@oQ34g37/@DEF*#\$BCX+,BCje!AmB7&Td0rxy<=0#\$*+*98X,ih i7~!7Q}'BCM='?'#\$vwB!*./"

\$vwB! "!"#\$%\$&'()*++ ,#-%.(/)70'1# *YjWk8m1l1Ce4b1&&"#234"5"6789# VE"1&&"#234"5":889# /mfm1l1*<ep<#WX#%R#UVH#\$EF*;;D<BC7a;H~n=1h#~<,\hXEFIJ&f=1*~hKQ0',"mje%n0o^X7N@:f7cEFIJ&f=1'W0r*~p"qrs6t "<.#+.+0*~#Qu-nS9#\$vw*BC<=0',"<.#+.+=(">0"#.#%".&'()*++ ,#-*?#7{BCQ)9;;D#\$EFh97/0S9TF*+XZv2,*@DBn#UV,'K7>#<eU,K7>#UVa%R[*,.0H"am1l1CeTF*'7X>K7'w)eh*lx+,p*stpf0v7y1<=0',&TXEX>K7>7'<=0',@8mnxy<eU,h7*TU&0BC"

SzTA74b'# \$vwB!?"~hjen{@pq7stDc*m=~h?2/0H~n=1h#?Q,,\h1L~<,\hH"=.)-.)*&&"*(. & " :8; ;# m, \ ;AD)9*#\$*+|7)9H~n=1*~h';DC6iX*#\$vwBC]l!{|-7Gr#\$vwB!"B.&.C)+D#.#*(. & " :8; ;# }ce(~h7?"nS'-.*)9*#\$vwB!"F"5*(. & " :8;8# mdl~!"8#\$vwB!|7Qbcn,j#*H~n=1~h"<&"*+*#G'H"(D":8;8# bc?Q,,\h7/;lDS8#\$EFBCKQf\$h_s#\$*+B!""J40',# "K.#L/>*":8; ;# a;7%~<,\h7/::X:MDefvw!{KQf#\$EFvwB!7f&)X Ae',y"Nn#\$*+*89BC"'!1W7Y04bcs(0")Jx"PQ7N)/O"(Jx#zd*'!&f)*BC*=1"PQ7P*&+/#GN*)&"":88A# /ef!{QRf*{BC#hi>BCa,.<!BC75X1#\$*+YZ&fde+q%h971Vg,DBCfq%h9?"4/2(")Jx7/-KY>&fw)*#\$./B!"B&"?Q)"H.&-"":8;8# })9N)/O(")Jx7?"nAe')9*#\$vwB!"Q").-G R)2ü# " :8;M# X4/5S"+GK/5&-"":8;M# })9@!8QTL=UJx7KQn.9ABX01#\$vwB!"

hx/)*BCKQ#\$vwB!*~h0{@7'ef~h|2m(&3v0"PQ7H~n=1J5dl!A7'M=1*'(&T/04U*+,4G4"mBC'(*;x*7@D)*BCjdx yF(+&*+G%"(5/efBCo+6/Jx*7{EF*12x8J+?z"?Q,,\ha~<,\hJ5j1o:!!{^!*s*7''M7Xeh98a*?8890X|a.607;1m<=[rxy#&*t*&7%bi" & f=7&A~h|8.9.9:0&A'0Tj/T1_Z*\]76+K!{9* vwBa

T U) V W X 5

! "\$ 7 " # "
B p 5 7 J
y d w 7 g _ '
a J I 5 9 7 6
p < "(! -
- | * 1 : '
2< =>94. / * 99
"X ' \$ l .
C m V g J
"# \$ * Z >
! / M Q x
X 7 1 { f
[S & Z A
", #
= 5
=D= 7 =C:=
%&6F 7 %&6
R) * G d 1
+ S 9 B C 3
b c n 7C 7 @
4 G 4 7 b m r
= 3 4 k p v
a 12332 .4 "%
"%&6'# * ! #
{ * = " F # 7
! 7 # \$ X p h
E F o | w * &
{ n "

~ + , 2 | *)
) * B C + ; C 6 i
K Q "
" (#) B C
~ _ ? " * *)
D E F '] N M D)
x / G s # \$ " M 7
' 0 B 9 x y a L M
? 7 ? 2 ' ~ f \$ 7
E F * S Z () , .
D 1 2 *) Q + , 7
6 ! " # \$ % &

CISS B ? 2 ' 8 9) * (* B C [C (& h 9 @ * \$ * + s # \$ E w * A ' I " 7 ~ ' (j e " = > R " 6 B > / & 7 B > R > * ; F % c L 8 [* 5 ; = E G ' u D 1 U V ~ _ C S 7 > Q J V V tive Max Lo 7 C 1 7 7 a 7 M 104 S \$ * V , m _ ' 7 ~ 7 c Q ' E F v V w 7 > # 7 G J V) * B C " G t . 9 # + & 8 ## | w C 7 u * b ' # y ? A S 9 # \$ & * W l k l X \$ + 0 1 * + 7 8 9 _ 7 b c , B C W X E F ~ r 7 * S { | - # e ? > " ; = E F * c ; = E F V * S ~ # ^ * B C " # V 7 ~ _ m \$ m B ? Q *) CISS " "d# ' e f ! { 13 D) * B C y \$! { a d T ' C 6 & D 2 I 1 (' T F

: " ~ ! ~ _ S '
l = K 7 V W *
@ A p i = 1 "
/ p d l = 1

M * 7 &_ B C
\$ a *,* - f
, " !, 8 D
p 6 5 7 /s
~ n " h X

M * 7.(* 7
- f >; 7 !&
W 1 * # \$ {
* *] H , > "
n * . n
D E F 8 a , .
% R E F 7 = 3
9 F 3 W X l = "
a U V E F a *
A E : ; ! \$ E
0 5 >> A T # ** 7
5 6 7 ! \$ - p x
3 7 ' S h > / ' E
i " M * 7 \$ E F B
Y 9 i - * c ~ 7 '
0 = B C [V ? | 7
~ " ~ ! 7 ~ _ c &
* c ~ 7 s C ' @ A
" 6 s W _ - # v ? :
. < ! d t ' @ E F
@ A v l = 1 " W r
(D Z [x B C 7]
T / 5 > * A T T d * *

" ~ n a h ~ n " d
n 7 &_ X &_ f c)

T U) V W X 5

Q m c "!"
- (D C n X 7
] m ,123 z {
- y##5 T T
"c ; > a U
~ _)
} O X ' V
o ^ 1 (h
!] H @ W
" (# 3
/) C
/ ' a] & 3 +
a ! 7 5 X 5 +
m ! c 5 + + 5
o h ~ A ? +
j e c) ! "
n 8 k n]
) d l * . 7 "
n " & T l {
W l * # n 5 + 2
b 0 s t { w Y
. ! 77 m | a 8 V
" d # < C ,
*) . ! z {
B C j e m " M
B ! m = { h j
1 # \$ G % Q 8
Q 8 @ l " W 1 *
= 1 2 < \ # " a f % r
\$ k p b c T F { k
X , 138 | 7 . ! 77
o E 7 \ p l . ! 77
} % (* K 7 E 8 p
] - & b 0 ~ h . ! 77
O g < = O v w Y Z
. ! 77 * % n O "
" , # ' g b c
@ =
c | h , . <
10 ! " # \$ % &

= ' *) ! " ## a M N # \$ v w B ! * W l ' y 7 ~ ! 7 0 ' 2 o ^ e (m = ~ h * ' 2 0 " n
\$ g 3) 6 ! " ## 1 L) 9 F h < B C # ' b 0 b c , . < ! - . * j e m = * # \$ v w B ! 7
@ % # " " j 1 o E 7 % # " ? 2 () | - V] K 7 7 b 0 I E [} a : * , + * < = 0 v w Y Z 7
~ ! 7 { B C * + , X u 2 G 4 s D 0 v " e : ' ~ f n M n | h m = - . 6 k l n \$ * + m T
F E F a V W % G % y P Q * " *) ! " ## } a ; , - # \$ - y * . x 2 : & & \$ E F , . 0 8
9 7 v 0 r 7 x y E n # \$ v w Y Z "

c # * + 8 , -

x y X w s # \$ v w ' i 2 [L M # \$ E F 3 0 # j e ! " # \$ % & * 1 2 8 { 7 ' 9 ' (
\$ - y * K - / 0 1 2 3 4 " S T A 7) \$ W M / - g * # \$ * + Y Z 7 + , F 4 n x y # \$
* + * \ i ~ h X o # z c 8 a z 2 m p l n " " ~ _ ? " n (D f g *) # \$ E F < = 0 # \$
v w * # K B ! & & *) ! " ## " a : 0 * # \$ v w B ! , k 7 *) ! " ## * 2 : m 9 a ; | h *
, . < ! - . ' \$ E F < B C j e m = 7 D , x y n # \$ * + m \$ D E F 8 a V W * x 8 7 1 !
9 i x y \$ < = 0 % # \$ v w * d w " *) ! " ## * i j ! { a ; A z T \$ " 0 r * \$ C # \$ * +
Y Z k p 1 K " ~ _ Y T , D ~ r j e n % n 0 o ^ 7 > m g 3 7 *) ! " ## * } 0 X ' * + Y Z
* x y 7 > r ' ! ' (* 4 g s t 7 , . < ! - . * 7 % m = ~ p 0 r V ? n *) ! " ## ' < = 0
Y Z * x y d w 7 j 1 f i 2 y ? L | w s # \$ * + V W 0 c * ' X " ~ _ * 3 4 j 1 j (} e
i 7 P o m g 3 7 *) X # 4 ## X

- [13] De Bandt O & Hartmann P. Systemic Risk: A Survey[J]. 2000
- [14] Giglio S & Kelly B & Pruitt S. Systemic Risk and the Macroeconomy: An Empirical Evaluation[J]. Journal of Financial Economics 7 2016 7 3 "119# 1 457–471
- [15] Girardi G & Erglen A T. Systemic Risk Measurement: Multivariate GARCH Estimation of CoVaR[J]. Journal of Banking and Finance 7 2013 7 8 "37# 1 3169–3180
- [16] Glasserman P & Young H P. How Likely Is Contagion in Financial Networks : [J]. Journal of Banking and Finance 7 2015 "50# 1 383–399
- [17] Grimaldi M. Detecting and Interpreting Financial Stress in the Euro Area[J]. 2010
- [18] Hakkio C S & Keeton W R. Financial Stress: What Is It? How Can It Be Measured? and Why Does It Matter : [J]. Economic Review 7 2009 7 2 "94# 1 5–50
- [19] Hollo D & Kremer M & Lo Duca M. CISS—A Composite Indicator of Systemic Stress in the Financial System[J]. 2012
- [20] Idier J & Lam G & M"sonnier J. How Useful Is the Marginal Expected Shortfall for the Measurement of Systemic Exposure : A Practical Assessment[J]. Journal of Banking and Finance 7 2014 "47# 1 134–146
- [21] Illing M & Liu Y. Measuring Financial Stress in a Developed Country: An Application to Canada[J]. Journal of Financial Stability 7 2006 7 3 "2# 1 243–265
- [22] Jobst M A & Gray M D F. Systemic Contingent Claims Analysis: Estimating Market–Implied Systemic Risk[M]. International Monetary Fund 7 2013
- [23] Kliesen K L & Smith D C. Measuring Financial Market Stress[J]. Economic Synopses 7 2010
- [24] Kremer M. Macroeconomic Effects of Financial Stress and the Role of Monetary Policy: A VAR Analysis for the Euro Area[J]. International Economics and Economic Policy 7 2016 7 1 "13# 1 105–138
- [25] LaBerge D & Samuels S J. Toward a Theory of Automatic Information Processing in Reading[J]. Cognitive Psychology 7 1974 7 2 "6# 1 293–323
- [26] Louzis D P & Vouldis A T. A Financial Systemic Stress Index for Greece[Z]. 2013
- [27] Nelson W R & Perli R. Selected Indicators of Financial Stability[J]. Risk Measurement and Systemic Risk 7 2007 "4# 1 343–372
- [28] Tobias A & Brunnermeier M K. CoVaR[J]. The American Economic Review 7 2016 7 7 "106# 1 1705
- [29] Van Roye B. Financial Stress and Economic Activity in Germany and the Euro Area[R]. Kiel Working Paper 7 2011
- [30] Wold S & Esbensen K & Geladi P. Principal Component Analysis[J]. Chemometrics and Intelligent Laboratory Systems 7 1987 7 1–3 "2# 1 37–52
- [31] Yiu M S & Ho W A & Jin L. A Measure of Financial Stress in Hong Kong Financial Market: the Financial Stress Index [J]. Hong Kong Monetary Authority Research Note 7 2010 "2# 1 2010

Abstract: It is critical for financial regulators to assess the overall level of stress in the financial system in a timely manner, but various financial markets often send mixed signals. To address this problem, this paper presents a single composite indicator of system stress "China CISS" based on 13 financial indicators of the equity market, the bond market, financial institutions and the foreign exchange market. To capture the stylized fact that co-movements between markets are much stronger during times of financial stress, the paper uses the time-varying correlation matrix between sub-indices as a dynamic weighting mechanism and identifies the episodes when both the covariance and co-extremeness across markets are jointly high as systemic stress events. Multiple robustness checks have been conducted and China CISS proves to be a kind of remarkably robust statistic in the time dimension.

Keywords: Systemic Financial Stress; Stress Indicator; CISS