

Tracking China Vulnerability in Real Time Using Big Data: The CVSI Index

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Summary

We have developed a **China Vulnerability Sentiment Index using Big Data**

The CVSI index allows us to track the **4 different vulnerability components: SOEs, Shadow Banking, Housing Bubble & FX speculative**

Robustness Check: “prior” inclusion of Sentiment Indicators is “Posterior” confirmed through **Bayesian Model Averaging (BMA)**

No Systematic Bias between English & Chinese Sentiment in Local and foreign media but **transitory deviations can affect market sentiment**

Additional **tools to track Risk in Real Time, with High Granularity and Geo-referenced Information.**

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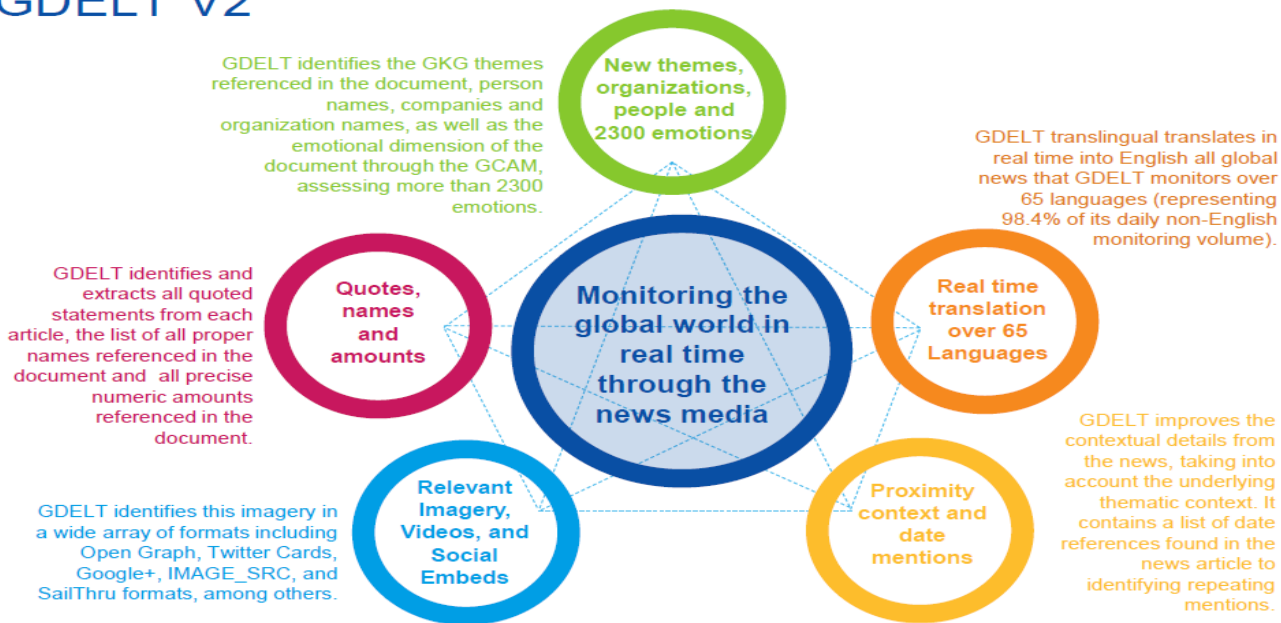
01

Measuring Sentiment Using GDELT

We introduce the Big Data (GDEL) analysis to track Different events, themes,

WHAT IS INSIDE AND ITS STRUCTURE?

GDEL V2



Sentiment & Economics: References

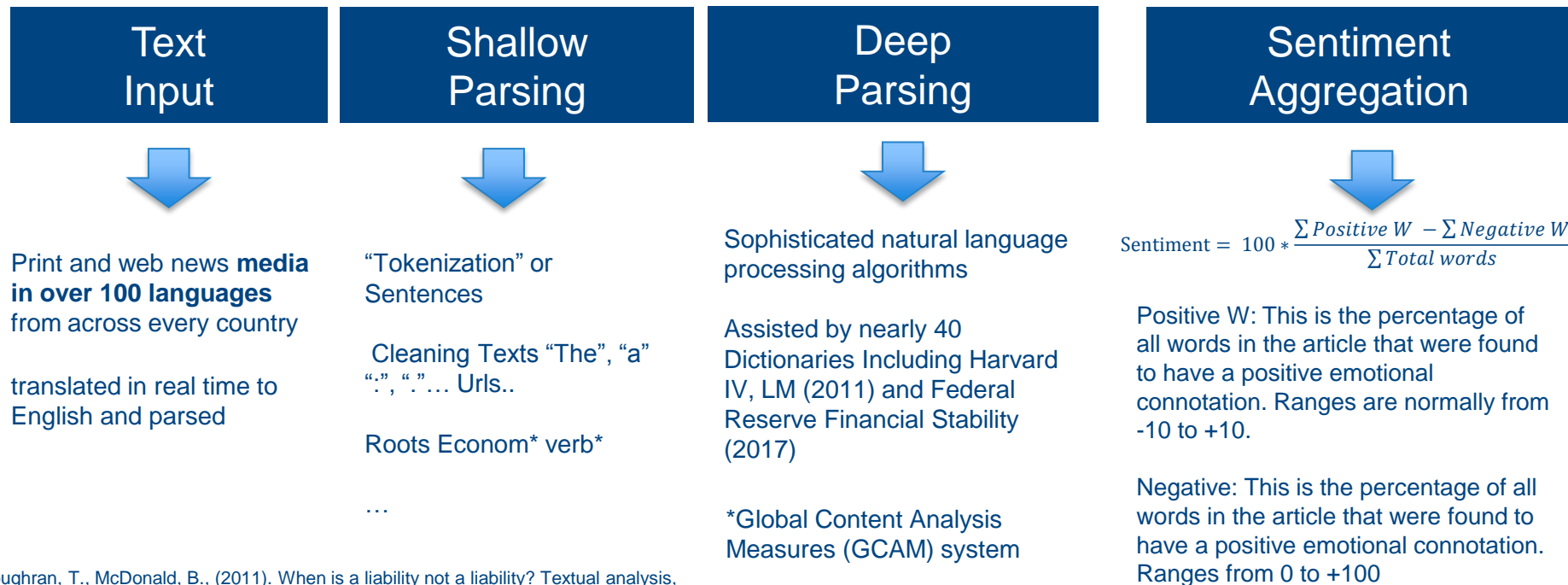
Theoretical Literature

- **Pigou (1927):** business cycle fluctuations are driven by expectations and entrepreneurs' errors of optimism and pessimism are crucial determinants of these fluctuations
- **Keynes (1936)** highlighted the importance of changes in expectations that are not necessarily driven by rational probabilistic calculations, but by “animal spirits”
- **Shiller (2017)** shows “narratives” can explain aggregate fluctuations through epidemic models.

Empirical Literature

- **Angeletos, Collard and Dellas (2015)** find that sentiment shocks account for around 1/2 of GDP variance and 1/3 of the nominal interest rate variance at business-cycle frequencies.
- **Barsky and Sims (2012)** found that this informational component forms the main link between sentiment and future activity in international business cycles.
- **Shapiro, Sudhoff, and Wilson (2017)** show how the news sentiment measures outperform the University of Michigan confidence index

Measuring Sentiment



Loughran, T., McDonald, B., (2011). When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks. Journal of Finance 66, 35-65

Correa,R Garud,K, Londono-Yarce,JM and Mislant, N. (2017) "Sentiment in central bank's financial stability reports". Federal Reserve IFDP

02

Estimation and Robustness Check

Tracking China Vulnerability in Real Time: Value Added from Big Data

**China
Vulnerability
Sentiment
Index**

**Hard Data
Indicators**

... provide accurate information
but at lower frequencies and with delays..

**Market
Indicators**

... Real Time but limited Information also
influenced by global factors...

**Sentiment
Indicators**

... complementing Hard-Soft-Markets
in Real Time “sentiment” on Special
topics not quotes.

A Balanced set of Information in the Database: Hard Data, Markets and Sentiment

China Vulnerability Sentiment Index (CVSI)			
SOE Vulnerability Index (SOEI)	Housing Bubble Vulnerability Index (HBI)	Shadow banking Vulnerability Index (SBI)	FX Speculative Pressure Index (FXI)
Principal Components Analysis on each component Tone			
Hard & Financial data			
Total.profits (M) Liabilities (M) 25%	Mortgages.loan (M) GICS.Housing.Index (M) Housing.Price (M) New.Construction (M) RealEst.Invest (M) 45%	NPL.Ratio (M) TSF.Aggregate.New Increase (M) Entrusted.Loans (M) Wenzhou.Index (D) WMPs Acceptances (M) 35%	Foreign.Reserves (D) CNY Exchange Rate (D) CNH Exchange Rate (D) HICNHON.Index (D) 40%
Real time sentiment indicators			
State owned enterprises (D) Resource misallocs & policy Failure (D) Resource misallocs & SOEs (D) Institutional reform & SOEs (D) Industry policy (D) Industry laws and regulations (D) Local government and SOEs (D) Debt and SOEs (D) 75%	Housing policy & institutions (D) Housing markets (D) Housing prices (D) Housing construction (D) Housing finance (D) Land reform (D) 55%	Non bank financial institutions (D) Asset management (D) Bank capital adequacy (D) Financial sector instability (D) Banking regulation (D) Infrastructure funds (D) Financial vulnerability & risks (D) Monetary & financial stability (D) State financial institutions (D) 65%	Currency exchange rate (D) Currency reserves (D) Capital account (D) Macprudential policy (D) Exchange rate policy (D) Illicit financial flows (D) 60%

A two step procedure to extract common vulnerability factor from Hard data, Markets and News Sentiment

1st Step Estimation: Components



2nd Step Estimation: Index

$$(1) \quad \text{SOEI} = \gamma_1 x_1 + \gamma_2 x_2 + \dots + \gamma_{10} x_{10} + \epsilon_1$$

$$(2) \quad \text{HBI} = \delta_1 y_1 + \delta_2 y_2 + \dots + \delta_{11} y_{11} + \epsilon_2$$

$$(3) \quad \text{SBI} = \beta_1 z_1 + \beta_2 z_2 + \dots + \beta_{15} z_{15} + \epsilon_3$$

$$(4) \quad \text{FXI} = \rho_1 v_1 + \rho_2 v_2 + \dots + \rho_{10} v_{10} + \epsilon_4$$

with $\gamma_i, \delta_i, \beta_i, \rho_i$ being the weight of every variable in the first principal component

$$(6) \quad \text{CSVl} = \mu_1 \text{SOE} + \mu_2 \text{HB} + \mu_3 \text{SB} + \mu_4 \text{FX} + \epsilon$$

with $\mu_1, \mu_2, \mu_3, \mu_4$ being the weight of every component in the first principal component of the four components

Results show the Importance of Sentiment

Chinese Vulnerability Sentiment Index (CVSI): Weights

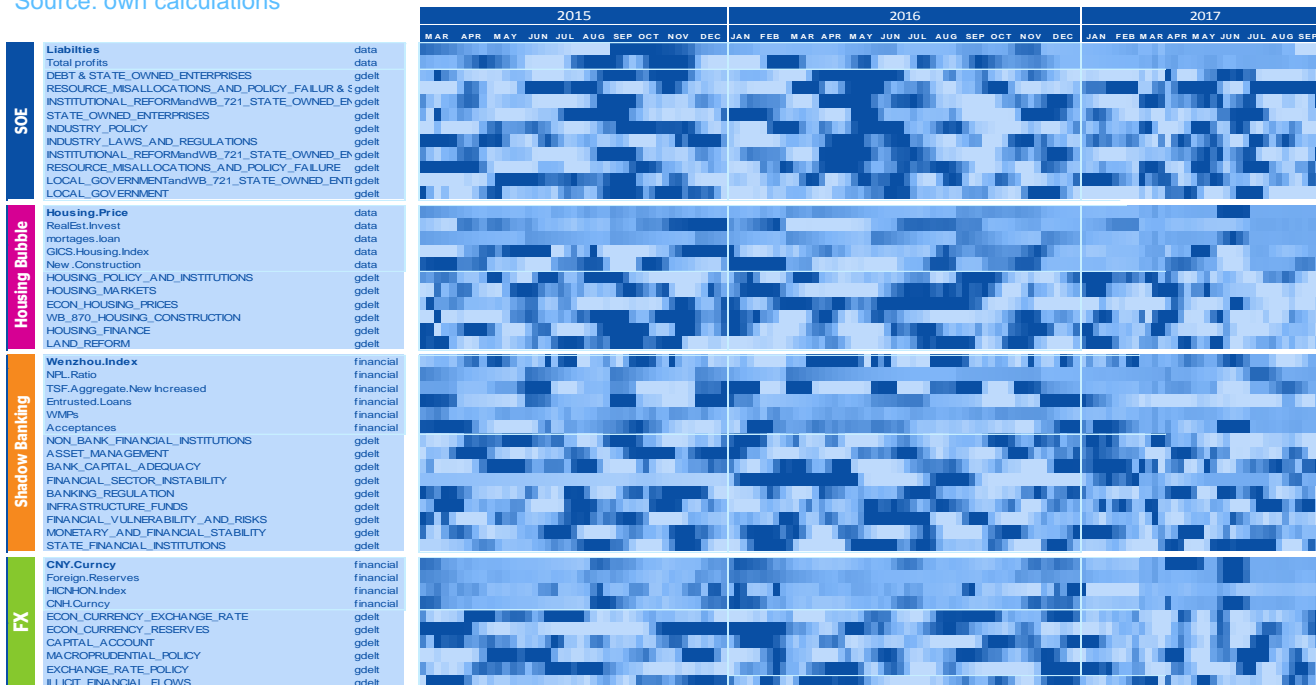
SOE Vulnerability			Housing Bubble			Shadow Banking			FX Speculative Pressure		
Variable (Type)		Weight	Variable (Type)		Weight	Variable (Type)		Weight	Variable (Type)		Weight
Tota Profits	(HD)	19.63	New Construction	(HD)	16.37	Wenzhou Index	(M)	16.58	Currency Exchange Rate	(S)	19.94
Institutional Reform & SOEs	(S)	12.37	Mortgages Loans	(HD)	14.57	WMP Yields	(M)	13.63	Exchange Rate Policy	(S)	17.95
Debt & SOE	(S)	11.92	Land Reform	(S)	12.62	Infrastructure_funds	(S)	10.92	Macroprudential_Policy	(S)	15.33
Liabilities	(HD)	10.62	Housing Price	(HD)	11.6	NPL ratio	(HD)	9.46	Hinchon Index	(M)	13.84
Local Government & SOE	(S)	9.75	Housing Construction	(S)	10.59	State & Financial Inst	(S)	8.95	CNY Currency	(M)	11.92
Industry Policy	(S)	9.5	Housing_Prices	(S)	10.05	Banking_Regulation	(S)	7.28	Capital Account	(S)	10.05
Resource Mis. & P. Failure	(S)	8.18	Housing Policy & Institutions	(S)	8.94	Financial Vulnerability	(S)	6.82	CNH Currency	(M)	8.73
SOE	(S)	7.15	Housing Finance	(S)	7.83	Asset_Management	(S)	5.62	Illicit Financial Flows	(S)	1.58
Industry Laws & Regulation	(S)	5.28	Housing Markets	(S)	6.71	Financial Sector Instability	(S)	5.35	Foreign Reserves	(S)	0.6
Resource Misalloc. & SOE	(S)	5.61	GICS Housing Index	(M)	0.36	Bank Capital Adequacy	(S)	4.6	Currency Reserves	(S)	0.06
			Real State Investment	(HD)	0.31	Non Bank Financial Inst	(S)	4.35			
						Monetary & F.Stability	(S)	3.54			
						Acceptances	(HD)	2.22			
						TSF Aggregate New	(HD)	0.57			
						Entrusted Loans	(HD)	0.13			
% of Sentiment in Component (S)		69.76	% of Sentiment in Component (S)		56.74	% of Sentiment in Component (S)		57.43	% of Sentiment in Component (S)		48.27
% of Variance by 1st PC		63.2	% of Variance by 1st PC		65.8	% of Variance by 1st PC		59.5	% of Variance by 1st PC		78.99
in the CSVI		29.18	Weight in the CSVI		26.05	Weight in the CSVI		23.12	Weight in the CSVI		21.64

Robustness Check: Co-movement (Hard-Market-Sentiment)

Chinese Vulnerability Sentiment Index Colour Map: Patterns and Comovements

(Standard values. Light Blue values indicate a improvement of sentiment while dark blue stands for higher vulnerability sentiment)

Source: own calculations



Vulnerability Intensity: Low High

Robustness Check: Do our selected variables account for “underlying” vulnerability

Posterior Inclusion Probability of a set of “X” candidates variables in explaining “Risk” (“Y”) (Risk=y= proxied by Chinese CD Swap)

$$p(y|M_\gamma, X, g) \propto (y - \bar{y})'(y - \bar{y})^{-\frac{N-1}{2}} (1+g)^{-\frac{k_\gamma}{2}} \left(1 - \frac{g}{1+g}\right)^{-\frac{N-1}{2}}$$

$$X_\gamma \in \{X\}$$

Zellner’s Uniform Prior (Non informative Prior, $\beta=0$)

$$\beta_\gamma | g \sim N \left(0, \sigma^2 \left(\frac{1}{g} X_\gamma' X_\gamma \right)^{-1} \right)$$

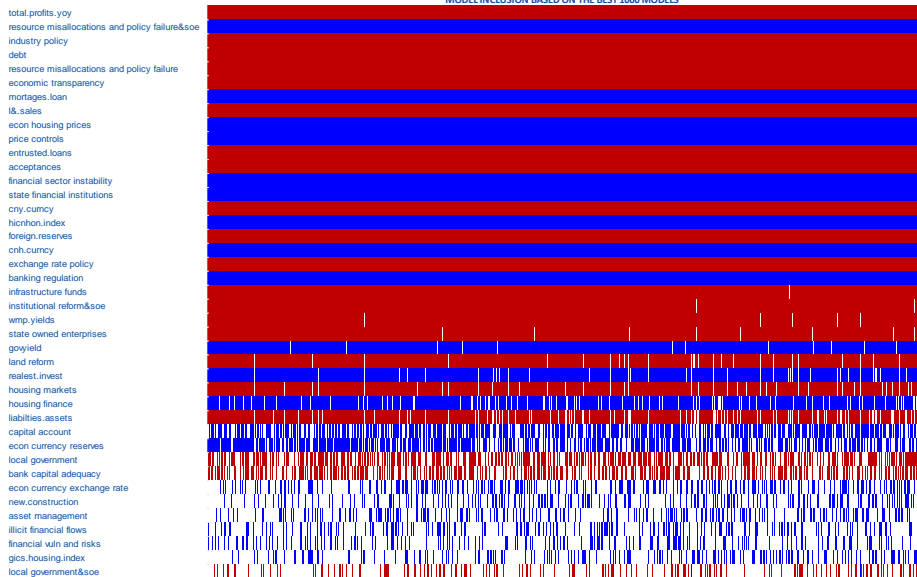
Hyperparameter “g” shows certain is the researcher fo B to be zero

Bayesian Model Averaging Robustness check confirms the relevance of Sentiment in explaining Market Risk proxies

Bayesian Model Averaging Results

(PIP Inclusion after 1000 models)

MODEL INCLUSION BASED ON THE BEST 1000 MODELS



Bayesian Model Averaging Results: X with PIP>50%

(PIP Inclusion after 1000 models)

	Dependent variable: CDS Spread	Type of data	Component	PIP	Posterior Mean	Posterior standard deviation SD
1	Total profits	Hard Data	SOE	1.000	-0.358	0.042
2	Institutional reform&SOE	Sentiment	SOE	1.000	-0.089	0.019
3	Industry policy	Sentiment	SOE	1.000	-0.112	0.015
4	Economic transparency	Sentiment	Shadow Banking	1.000	-0.069	0.015
5	mortgages loan	Hard Data	Housing bubble	1.000	1.014	0.105
6	housing finance	Sentiment	Housing bubble	1.000	0.086	0.016
7	NPL ratio	Financial	Shadow Banking	1.000	-0.976	0.130
8	Acceptances	Financial	Shadow Banking	1.000	-0.264	0.053
9	CNY currency	Financial	FX	1.000	-0.811	0.086
10	Econ currency reserves	Sentiment	FX	1.000	0.129	0.020
11	Exchange rate policy	Sentiment	FX	1.000	-0.113	0.017
12	Illicit financial flow s	Sentiment	FX	1.000	0.063	0.015
13	Industry law s and regulations	Sentiment	SOE	0.995	0.062	0.016
14	Hicnon index	Financial	FX	0.994	0.080	0.022
15	State ow ned enterprises	Sentiment	SOE	0.953	-0.055	0.020
16	Econ housing prices	Sentiment	Housing bubble	0.927	0.058	0.025
17	Financial sector instability	Sentiment	Shadow Banking	0.908	0.089	0.038
18	Wenzhou index	Financial	Shadow Banking	0.860	0.071	0.040
19	Asset managment	Sentiment	Shadow Banking	0.817	0.042	0.025
20	Banking regulation	Sentiment	Shadow Banking	0.791	0.032	0.020
21	Macprudential policy	Sentiment	FX	0.716	-0.030	0.023
22	Housing policy and institutions	Sentiment	Housing bubble	0.706	0.030	0.023
23	New construction	Hard Data	Housing bubble	0.697	0.045	0.035
24	Entrusted loans	Financial	Shadow Banking	0.674	-0.072	0.058
25	Real Estate Investment	Hard Data	Housing bubble	0.655	0.055	0.048
26	Non bank Financial institutions	Sentiment	Shadow Banking	0.655	-0.029	0.025

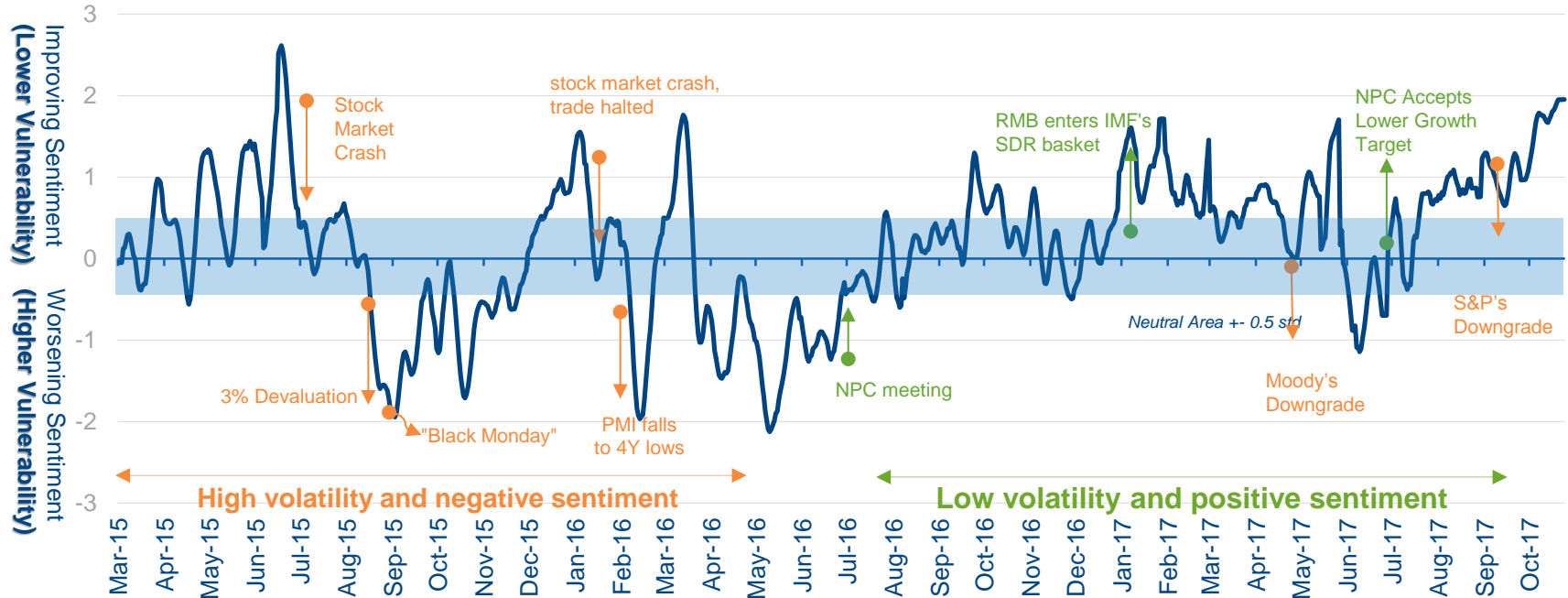
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Results: The CVSI index

The index shows that Vulnerability sentiment has been improved since the authorities implemented some policies

Chinese Vulnerability Sentiment Index (CVSI)

(Evolution of the "Tone" or "Sentiment". Lower values indicate a deterioration of sentiment and higher vulnerability)

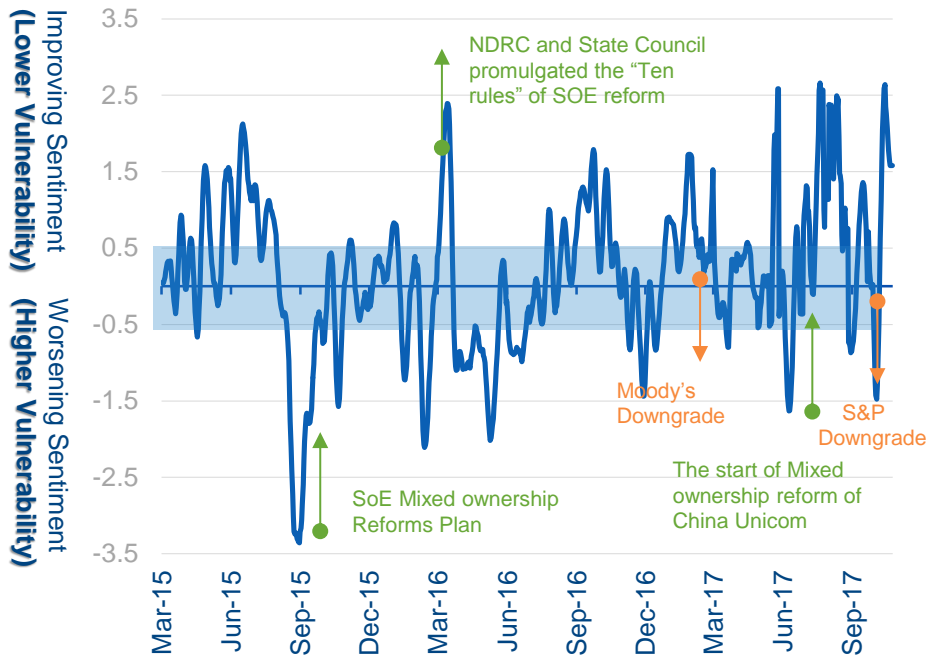


Source: www.gdelt.org & Own Calculations

Some components have some an important response to policy changes (i.e Shadow Banking)

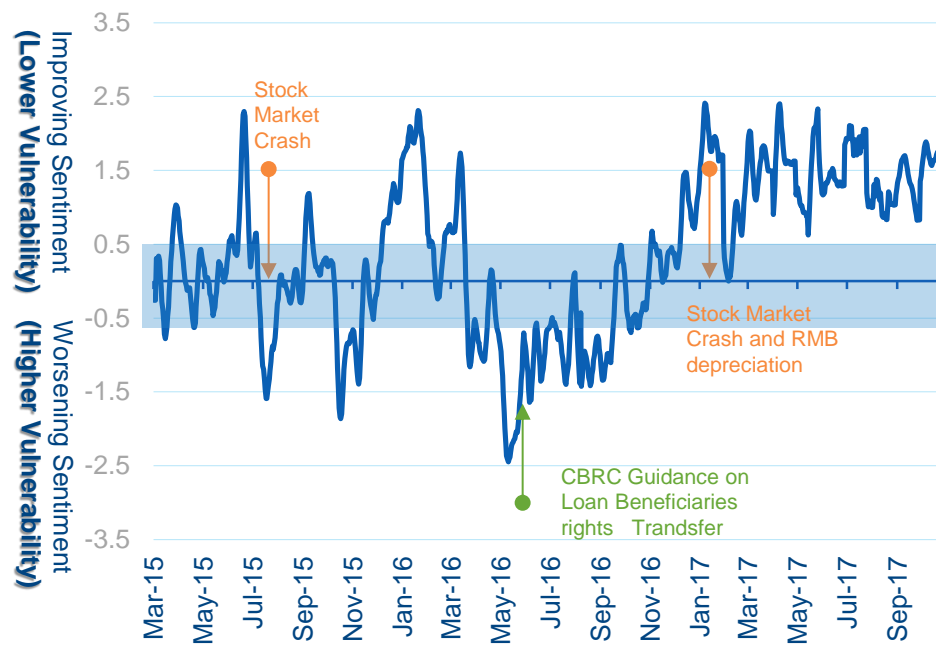
CVSI: SOEs Component

(Evolution of the “Tone” or “Sentiment”.)



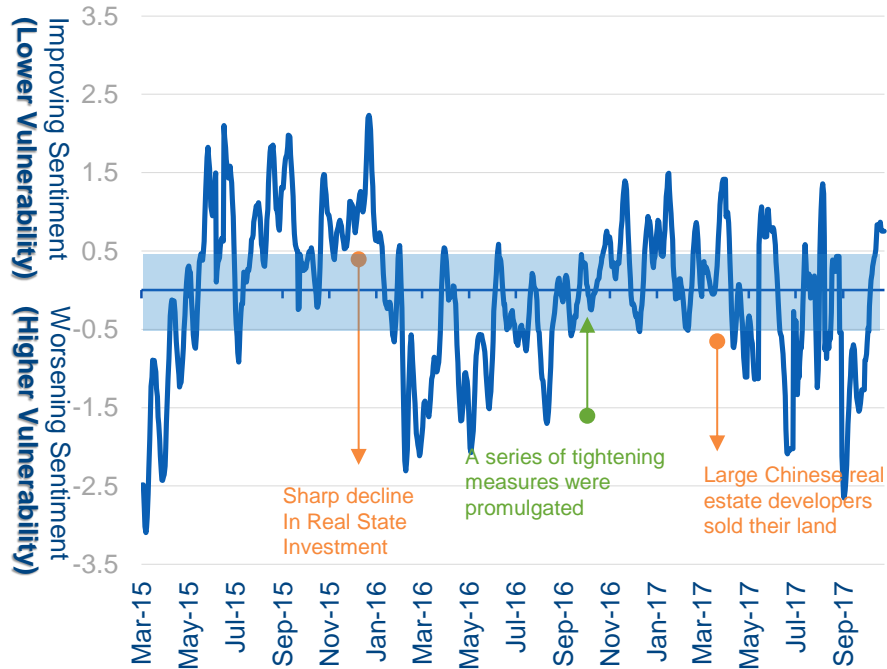
CVSI: Shadow Banking Component

(Evolution of the “Tone” or “Sentiment”.)

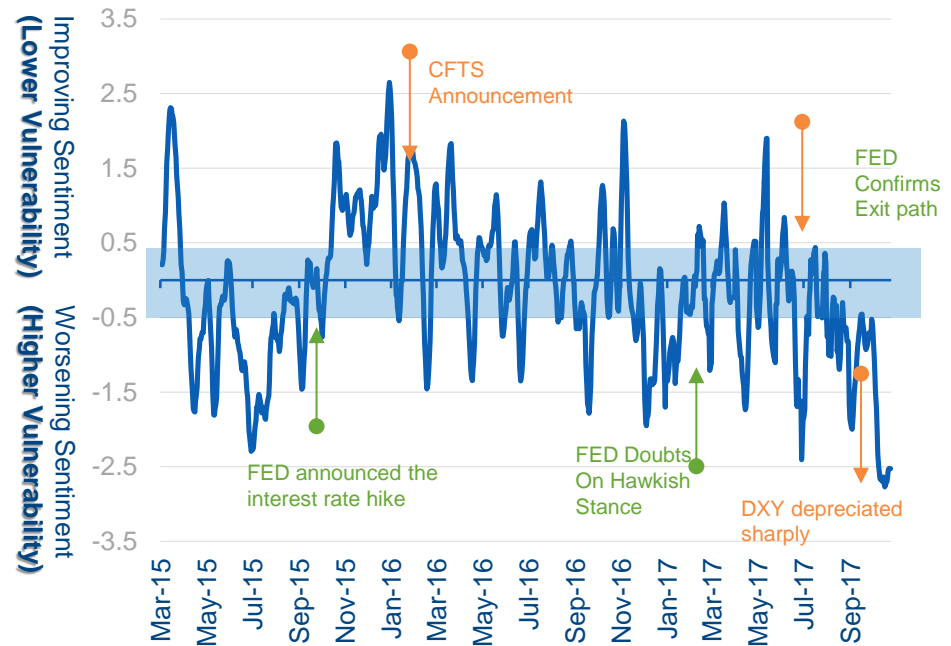


Other components present more random performance with some dependence of global affairs (External)

CVSI: Real State Component
(Evolution of the "Tone" or "Sentiment".)



CVSI: External
(Evolution of the "Tone" or "Sentiment".)



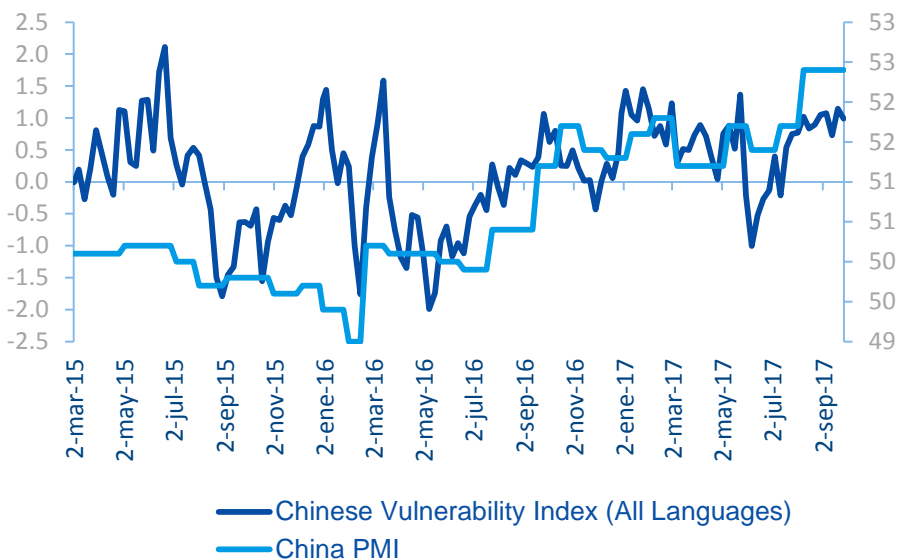
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Additional Risk Analysis Tools

The CSVI is associated to other High Frequency Indicators as Growth and Market Risk

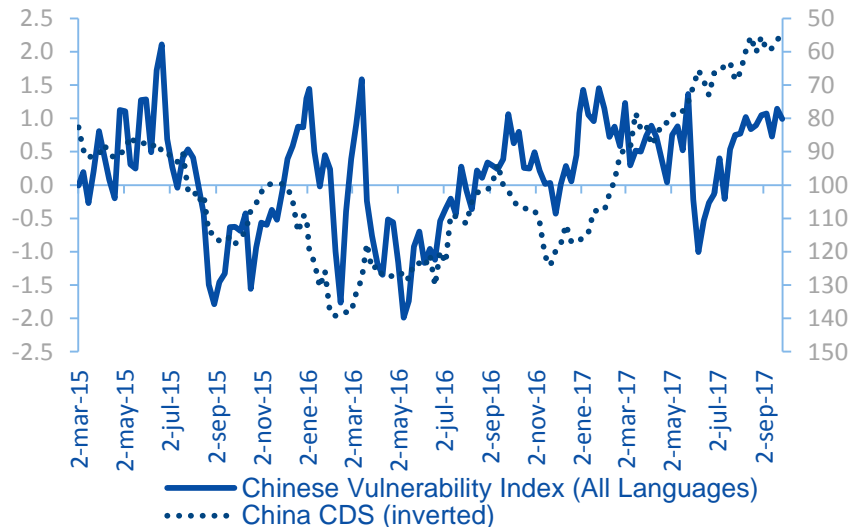
CVSI Index and Economic Activity (PMI)

(index and net balance)



CVSI Index and Risk Premia (CDS)

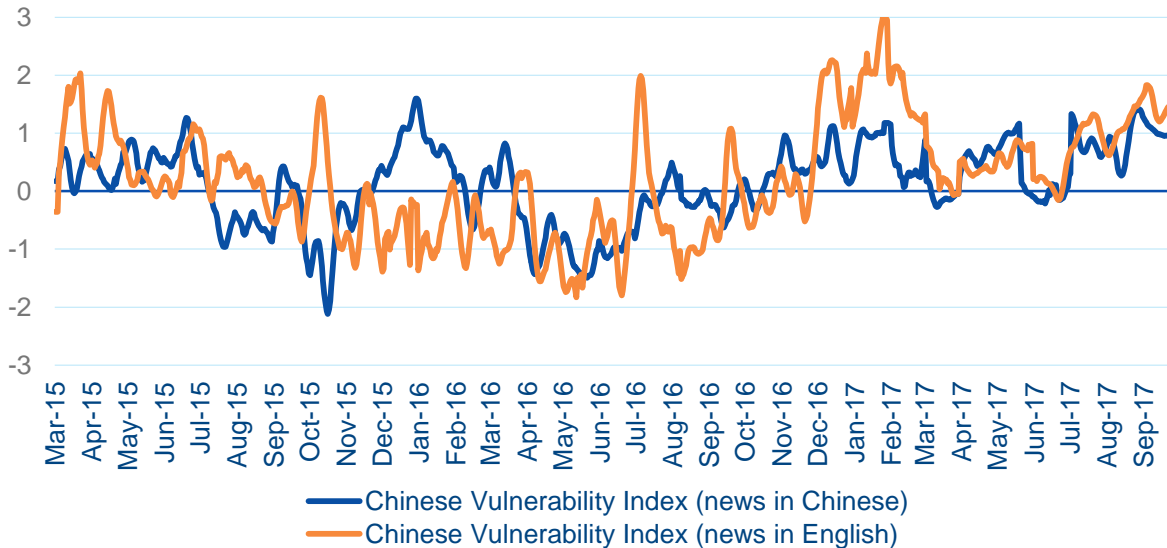
(index and basis points Inverted)



Chinese Vulnerability Sentiment Index: total news VS Chinese news

Chinese Vulnerability Sentiment Index: total, Chinese and English

(Evolution of the “Tone” of main followed themes about vulnerability in China in Madaring and Non –Translated- English)



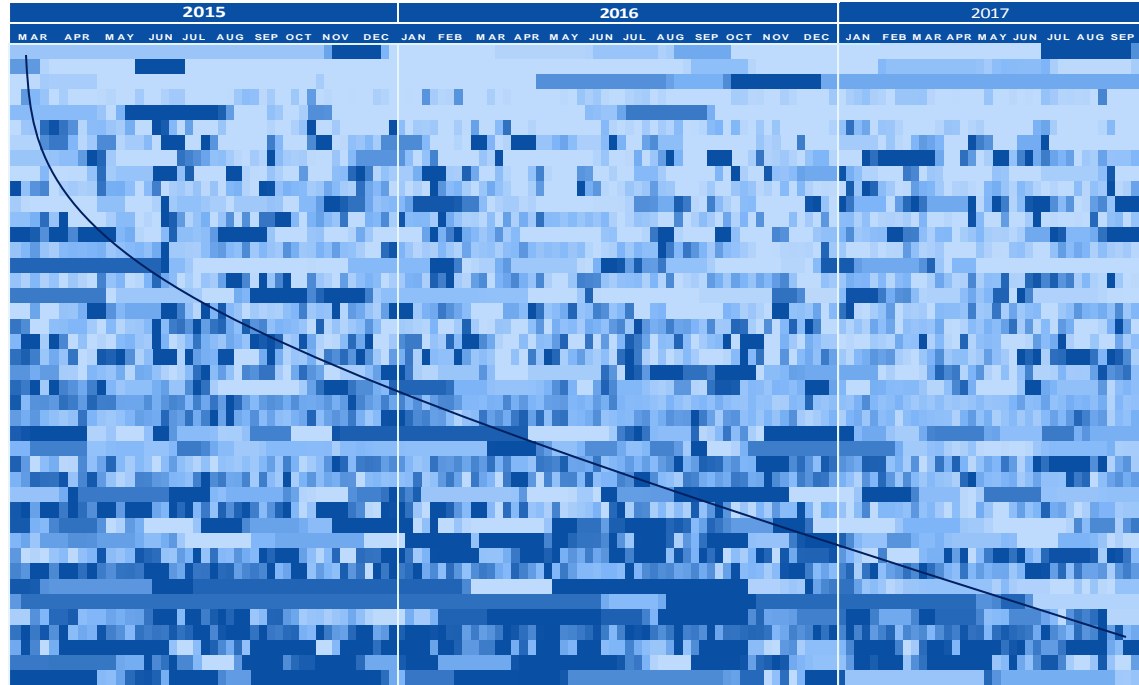
No Systematic Bias in English & Chinese Language Media

Transitory divergences Can affect markets

It can be used to analyze vulnerability in a very granular way...

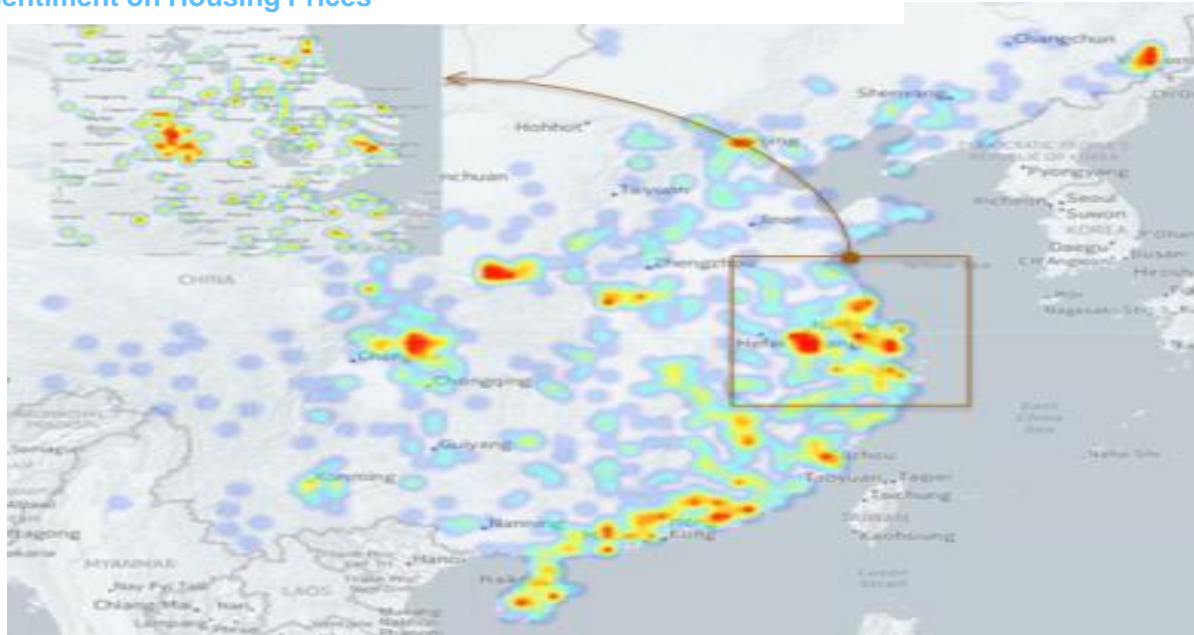
China SOE Sentiment Diffusion Map (sentiment on SOE)

- Soe Company**
- China International Intellectual
 - Dongfang Electric
 - China Energy Conservation Environmental Protection Group
 - China Aerospace Science
 - China Coal Tech
 - Harbin Electric
 - China Datang
 - China Guodian
 - China Electronics Co
 - Dongfeng Motor
 - China Electronics Technology Group Corporation
 - China Minmetal**
 - China Southern Power Grid
 - China Telecom
 - China National Travel Service
 - Sinochem**
 - China National Chemical Engineering
 - China United Network
 - China State Construction Engineering
 - China Huaneng
 - China Shipbuilding Industry Corp
 - China Nuclear Energy
 - Chalco**
 - Sinopec**
 - China Mobile
 - China Shipbuilding Corp
 - China National Aviation Holding
 - China National Chemical Co
 - China Communications Construction
 - Sinosteel Corporation
 - Shenhua Group
 - China National Building Materials Group
 - Ansteel
 - Cofco**
 - China National Petroleum Corporation**
 - China National Salt
 - Chinese State Grid Corporation
 - China First Heavy Industries
 - Cnocc**
 - China Nonferrous Metals
 - China National Coal Group
 - China Grain Reserves



Including Geo referenced risks

Geographical Analysis Housing Prices (sentiment on Housing Prices)



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