

# Tracking China's Economic and Financial Vulnerability in Real Time Using Big Data

BBVA Research

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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:  
**Indebtedness, Shadow Banking, Housing & FX**

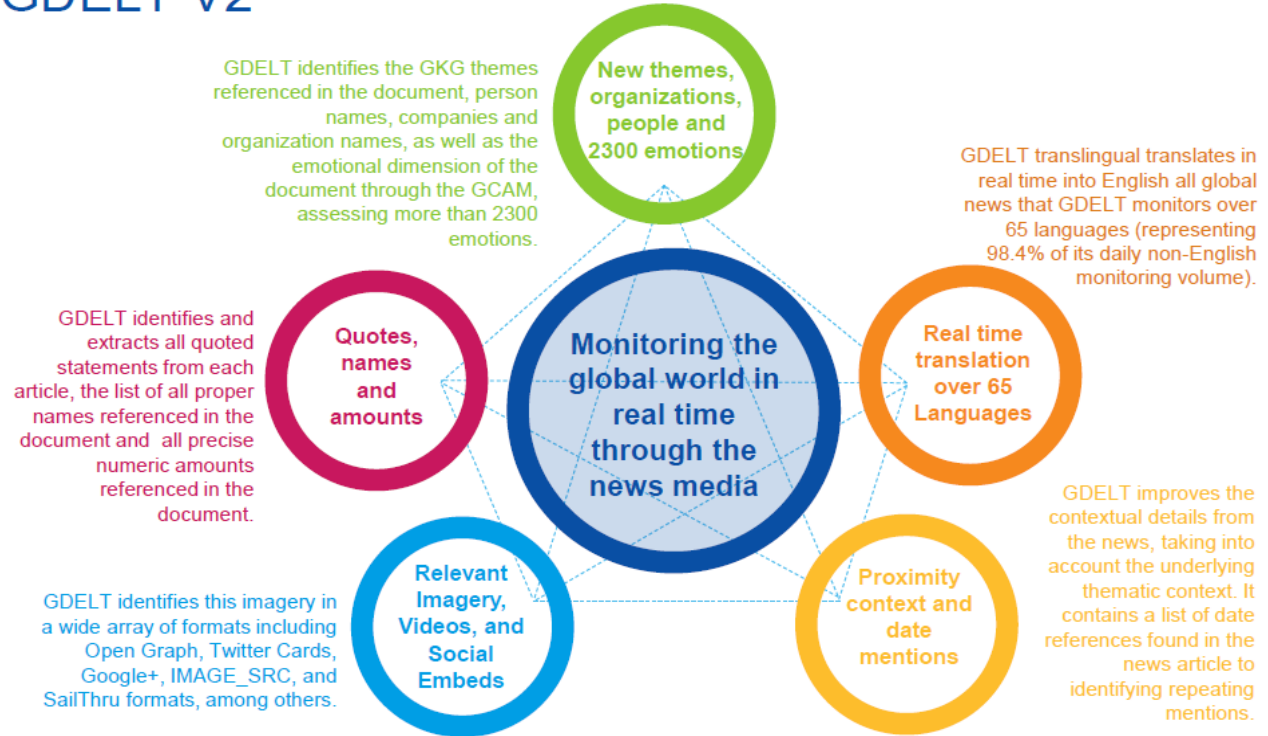
Robustness Check: “prior” inclusion of Sentiment Indicators is “Posterior” **confirmed through Bayesian Model Averaging (BMA)**

**No Systematic Bias** between English & Chinese Sentiment in Local and foreign media.

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

WHAT IS INSIDE AND ITS STRUCTURE?

## GDELT V2



# We can extract more than 2300<sup>th</sup> emotions of more than 30000 topics in thousands of Newspapers of the world (Chinese & English) in real time

GKG DATABASE

Themes. More than 30000...

## THEMES

AGRICULTURE	ECON_BANKRUPTCY	EXHUMATION	MOVEMENT_ENVIRONMENTAL	SELF_IDENTIFIED_ATROCITY
ALLIANCE	ECON_COST_OF_LIVING	EXILE	MOVEMENT_GENERAL	SELF_IDENTIFIED_ENVIRON_DREAFTER
APPOINTMENT	ECON_CURRENCY_EXCHANGE_RATE	EXTREMISM	MOVEMENT_OTHER	SELF_IDENTIFIED_HUMAN_RIGHTS
ARMEDCONFLICT	ECON_CURRENCY_RESERVES	FIREARM_OWNERSHIP	MOVEMENT_SOCIAL	SELF_IDENTIFIED_HUMANITARIAN_CRISIS
ASSASSINATION	ECON_DEBT	FOOD_SECURITY	MOVEMENT_WOMENS	SEPARATISTS
AUSTERITY	ECON_DEREGULATION	FOOD_STAPLE	NATURAL_DISASTER	SHORTAGE
AUTAVION_INCIDENT	ECON_EARNINGSREPORT	FREE SPEECH	NEGOTIATIONS	SLFD_CAPACITY_BUILDING
BAN	ECON_ENTREPRENEURSHIP	FUEL PRICES	NEW_CONSTRUCTION	SLFD_CIVIL_LIBERTIES
BLACK_MARKET	ECON_HOUSING_PRICES	GENERAL_VIOLENCE	ORGANIZED_CRIME	SLFD_DICTATORSHIP
BLOCKADE	ECON_INFORMAL_ECONOMY	GENERAL GOVERNMENT	PEACEKEEPING	SLFD_ECONOMIC_DEVELOPMENT
BORDER	ECON_INTEREST_RATES	GENERAL HEALTH	PERSECUTION	SLFD_ECONOMIC_POWER
BULLYING	ECON_IPRO	GENITIFICATION	PHONE_OUTAGE	SLFD_MILITARY_BUILDUP
CEASEFIRE	ECON_MONOPOLY	GRIEVANCES	PIPELINE_INCIDENT	SLFD_MILITARY_READINESS
CHARISMATIC_LEADERSHIP	ECON_NATIONALIZE	HARASSMENT	PIRACY	SLFD_MINERAL_RESOURCES
CHECKPOINT	ECON_REMITTANCE	HATE_SPEECH	POLITICAL_PRISONER	SLFD_NATURAL_RESOURCES
CLAIM_CREDIT	ECON_STOCKMARKET	HEALTH_PANDEMIC	POLITICAL_TURMOIL	SLFD_PEACE_BUILDING
CLOSURE	ECON_SUBSIDIES	HEALTH_SEXTRANSIDISEASE	POPULATION_DENSITY	SLFD_POLITICAL_BOUNDARIES
CONFISCATION	ECON_TAXATION	HUMAN_TRAFFICKING	POVERTY	SLFD_RULE_OF_LAW
CONSTITUTIONAL	ECON_TRADE_DISPUTE	IDEOLOGY	POWER_OUTAGE	SLUMS
CORRUPTION	ECON_UNIONS	IMMIGRATION	PRIVATIZATION	SMUGGLING
CRIME_CARTELS	ENV_BIOFUEL	IMPEACHMENT	PROPAGANDA	SOVEREIGNTY
CRIME_COMMON_ROBBERY	ENV_CARDIOVASCULATURE	INBURYGENCY	PROPERTY_RIGHTS	STATE_OF_EMERGENCY
CRIME_ILLEGAL_DRUGS	ENV_CLIMATECHANGE	INTERNET_BLACKOUT	PUBLIC_TRANSPORT	STRICK
CYBER_ATTACK	ENV_COAL	INTERNET_CENSORSHIP	RAIL_INCIDENT	SURVEILLANCE
DEATH_PENALTY	ENV_DEFORESTATION	JHAD	RAPY	TAKE_OFFICE
DEFECTION	ENV_FISHERY	LANDMINE	REBELLION	TERRO
DELAY	ENV_FORESTRY	LEADER	REBELS	TORTURE
DEMOCRACY	ENV_GEOETHERMAL	LEGALIZATION	RECRUITMENT	TOURISM
DISABILITY	ENV_GREEN	LEGISLATION	RELATIONS	TRAFFIC
DISCRIMINATION	ENV_HYDRO	LOST	RELEASE_HOSTAGE	TRANSPARENCY
DRINK	ENV_METALS	LITERACY	RELEASE_PRISON	TREASON
DRUG_TRADE	ENV_MINING	LEGISLATION	RELIGION	TRIAL
	ENV_NATURALGAS	MANMADE_DISASTER	RESIGNATION	UNEMPLOYMENT
	ENV_NUCLEARPOWER	MARITIME_INCIDENT	RETAILLATE	UNGOVERNED
	ENV_OIL	MARITIME_INCIDENT IMPLIED	RETIREMENT	UNSAFE_WORK_ENVIRONMENT
	ENV_OVERFISH	MARITIME_INCIDENT_SELF_IDENTIFIED	RETIREMENTS	URBAN
	ENV_SOLAR	MEDIA_CENSORSHIP	ROAD_INCIDENT	URBAN_SPAWAL
	ENV_WATERWAYS	MEDIA_MSM	RURAL	VANDALIZE
	ENV_WINDPOWER	MEDIA_SOCIAL	SANCTIONS	VETO
		MEDICAL	SANITATION	VIOLENT_UNREST
		MEDICAL_SECURITY	SCANDAL	WATER_SECURITY
		ML_SELF_IDENTIFIED_ANMS_DEAL	SCIENCE	WHISTLEBLOWER
		ML_RESPONSES_PROLIFERATION	SECURITY_SERVICES	WMD
		MILITARY	ESGE	
		MILITARY_COOPERATION		



GKG DATABASE

## World Bank Taxonomy

### World Bank Taxonomy (Themes)

- Agriculture and Food Security
- Climate Change
- Economic Growth
- Education
- Energy and Extractives
- Environment and Natural Resources
- Financial Sector Development
- Fragility, Conflict and Violence
- Gender
- Health, Nutrition and Population
- Information and Communication Technologies (ICT)
- Jobs
- Macroeconomic and Structural Policies
- Macroeconomic Vulnerability and Debt
- Poverty
- Private Sector Development
- Public Sector Management
- Public-Private Partnerships (PPP)
- Social Development
- Social Protection and Labor
- Trade
- Transport
- Urban Development
- Water

### Macroeconomic and Structural Policies

- Fiscal Policy
- Macroeconomic Modelling and Statistics
- Macroeconomic Monitoring
- Macroeconomic Policy
- Monetary Policy
- Sovereign Asset Management
- Structural Policy and Reform

### Macroeconomic and Structural Policies

- Aid Dependence
- Balance of Payments
- Debt
- Deflation
- Economic Shocks and Vulnerability
- Financial Sector Instability
- Financial Sector Liabilities
- Fiscal Balance
- Fiscal Policy and Inequality
- Fiscal Risks
- Inflation
- Macro-Vulnerability
- Macroeconomic Imbalances and Adjustments
- Macroeconomics of Conflict and Fragility
- Price Volatility
- Soft Budget Constraints

# Sentiment and real economy

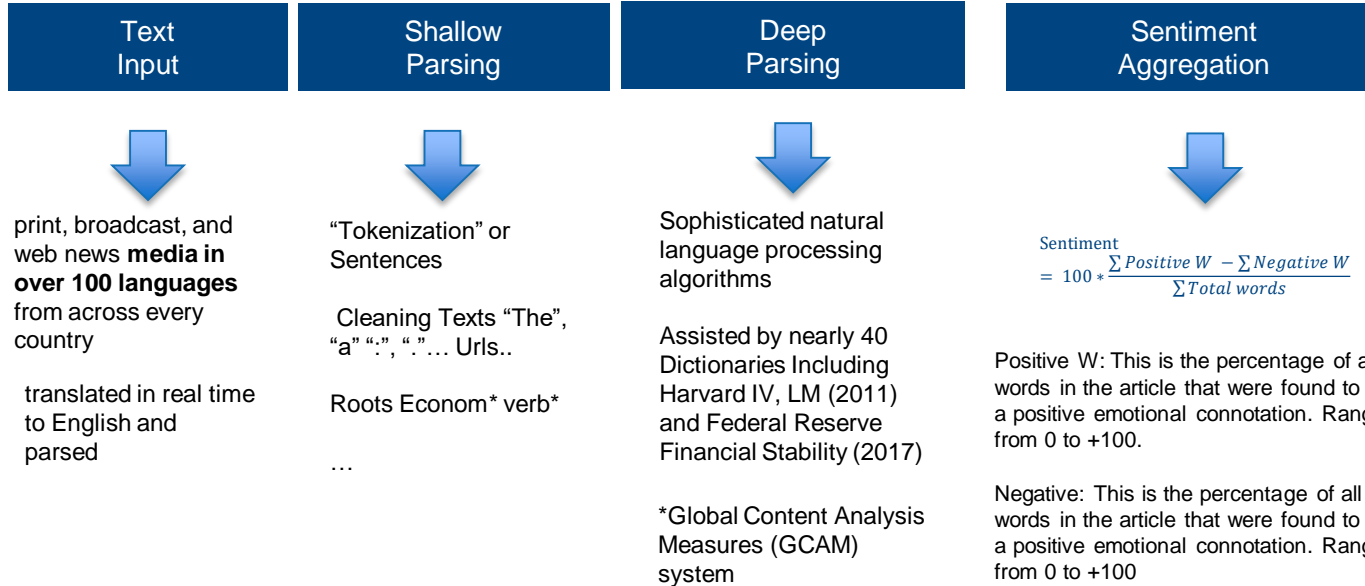
## Theoretical Literature

- Pigou (1927): business cycle fluctuations are driven by expectations and entrepreneurs' errors of optimism and pessimism are crucial determinants of these fluctuations
- Keynes (1936) highlights 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.

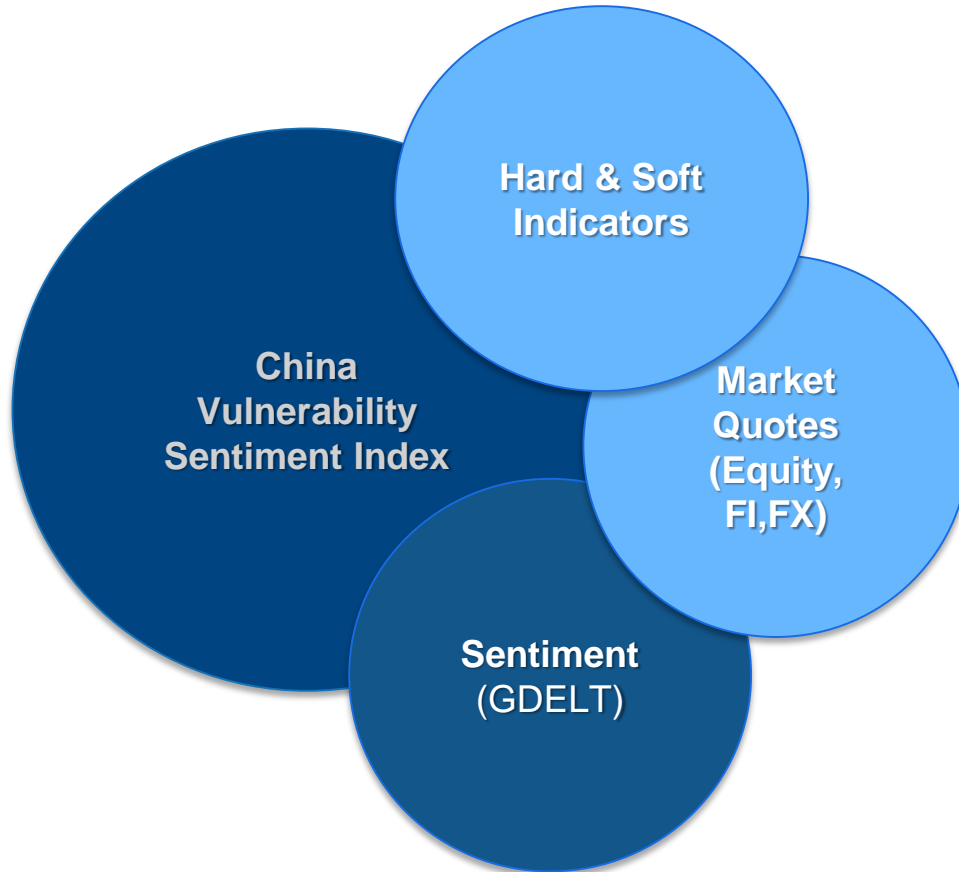
## Empirical Literature

- 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) find 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
- Shen, Xia, Shuai, and Gao (2022) show that some constructed measures of new media sentiments have significant predictive power for Chinese stock market returns and volatilities.

# Measuring Sentiment



# Tracking China Vulnerability in Real Time: Value Added through Big Data



... provide accurate information  
But not in real time...

... Support with Sentiment  
Though Market Movements

... Real Time analysis of 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)  <b>25%</b>	Mortgages loan (M) GICS.Housing.Index (M) Housing.Price (M) New.Construction (M) RealEst.Invest (M)  <b>45%</b>	NPL.Ratio (M) TSF.Aggregate.New Increase (M) Entrusted.Loans (M) Wenzhou.Index (D) WMPs Acceptances (M)  <b>35%</b>	Foreign.Reserves (D) CNY Exchange Rate (D) CNH Exchange Rate (D) HICNHON.Index (D)  <b>40%</b>
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)  <b>75%</b>	Housing policy & institutions (D) Housing markets (D) Housing prices (D) Housing construction (D) Housing finance (D) Land reform (D)  <b>55%</b>	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)  <b>65%</b>	Currency exchange rate (D) Currency reserves (D) Capital account (D) Macroprudential policy (D) Exchange rate policy (D) Illicit financial flows (D)  <b>60%</b>



# Results show the Importance of Sentiment

## 1<sup>st</sup> Step Estimation: Components

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

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

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

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

$$(5) \quad \omega_i = \frac{\sum_{j=1} \lambda_j X_{ji}}{\sum_{j=1} \lambda_j}$$

## 2nd Step Estimation: Index

$$(6) \quad CSVI = \mu_1 SOE + \mu_2 HB + \mu_3 SB + \mu_4 FX + \epsilon$$

## Chinese Vulnerability Sentiment Index (CVSI): Weights

Variable	Weights	Variable	Weights	Variable	Weights	Variable	Weights
Total profits	19.63	New Construction	16.37	Wenzhou Index	16.58	Currency_exchange_rate	19.94
Institutional_reform_and_SOEs	12.37	mortgages loan	14.57	WMP Yields	13.63	Exchange_rate_policy	17.95
Debt_and_SOEs	11.92	Land_reform	12.62	Infrastructure_funds	10.92	Macroprudential_policy	15.33
Local_government_and_SOEs	9.75	Housing Price	11.60	NPL Ratio	9.46	HICNHON Index	13.84
Industry_policy	9.50	Housing_construction	10.59	State_financial_institutions	8.95	CNY Curncy	11.92
Resource_misallocations_and_policy_failure	8.18	Housing_prices	10.05	Banking_regulation	7.28	Capital_account	10.05
SOEs	7.15	Housing_policy_and_institutions	8.94	Financial_vulnerability_and_risks	6.82	CNH Curncy	8.73
Liabilities	10.62	Housing_finance	7.83	Asset_management	5.62	Illicit_financial_flows	1.58
Industry_laws_and_regulations	5.28	Housing_markets	6.71	Financial_sector_instability	5.35	Foreign_Reserves	0.60
Resource_misallocations_and_SOEs	5.61	GICS Housing Index	0.36	Bank_capital_adequacy	4.60	Currency_reserves	0.06
		Real Est. Investment	0.35	Non_bank_financial_institutions	4.35		
				Monetary_and_financial_stability	3.54		
				Acceptances	2.22		
				TSF Aggregate New/Increased	0.57		
				Entrusted Loans	0.13		
<b>SOE Vulnerability Index</b>		<b>29.18</b>		<b>Housing Bubble Vulnerability Index</b>		<b>26.05</b>	
				<b>Shadow banking Vulnerability Index</b>		<b>23.12</b>	
				<b>FX Speculative Pressure Index</b>		<b>21.64</b>	

## China Vulnerability Sentiment Index

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

BMA will help us to set the X variables should be Included in a Regression to Explain Market Risk (i.e CDS)

$$y = \alpha_\gamma + X_\gamma \beta_\gamma + \varepsilon \quad \varepsilon \sim N(0, \sigma^2 I)$$

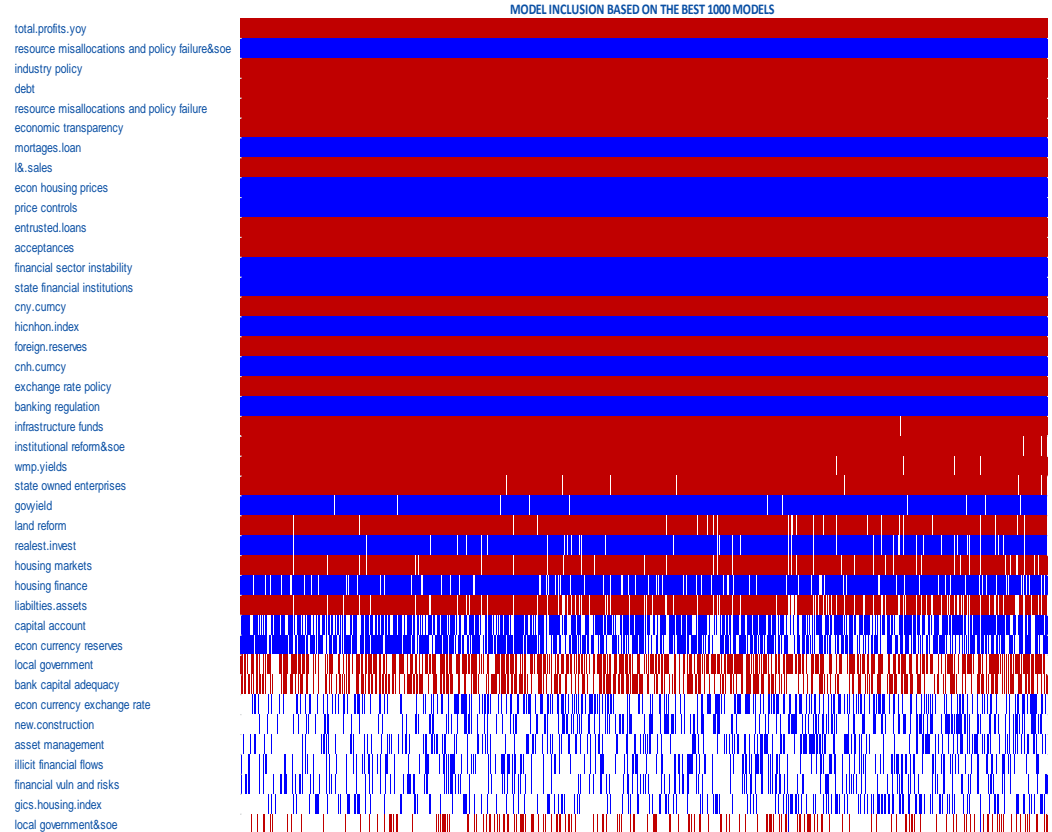
$$X_\gamma \in \{X\}$$

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

Zellner's Uniform Prior

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

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



# Robustness Check through BMA

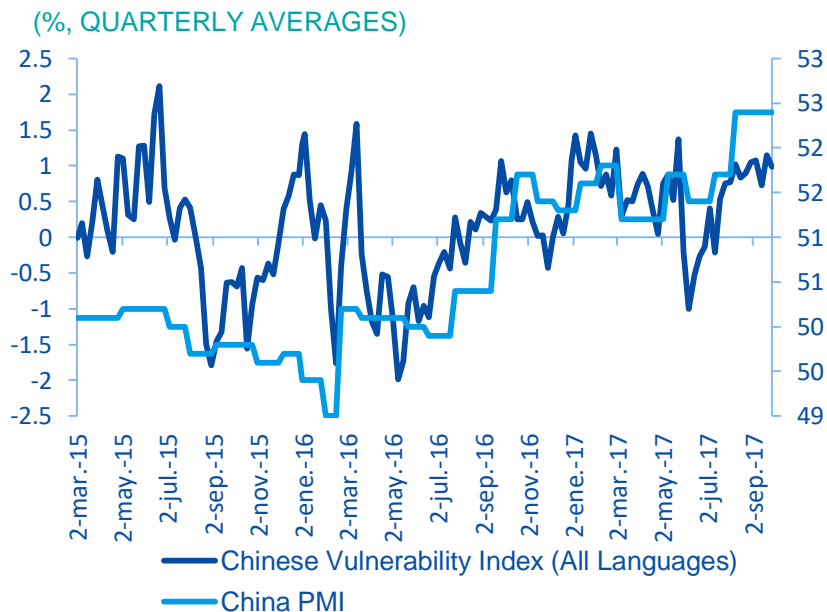
Dependent variable: CDS Spread	Type of data	Component	PIP	Posterior Mean	Posterior standard deviation SD
1 Total profits	Hard Data	SOE	1.000	-0.358	0.042
2 Institutional reform&SOE	Sentiment	SOE	1.000	-0.089	0.019
3 Industry policy	Sentiment	SOE	1.000	-0.112	0.015
4 Economic transparency	Sentiment	Shadow 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 flows	Sentiment	FX	1.000	0.063	0.015
13 Industry laws and regulations	Sentiment	SOE	0.995	0.062	0.016
14 Hicnon index	Financial	FX	0.994	0.080	0.022
15 State owned 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 management	Sentiment	Shadow Banking	0.817	0.042	0.025
20 Banking regulation	Sentiment	Shadow Banking	0.791	0.032	0.020
21 Macroprudential 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

BMA Analysis shows that 16 out of 26 (61%) Variables with PIP above 50% are Sentiment ones



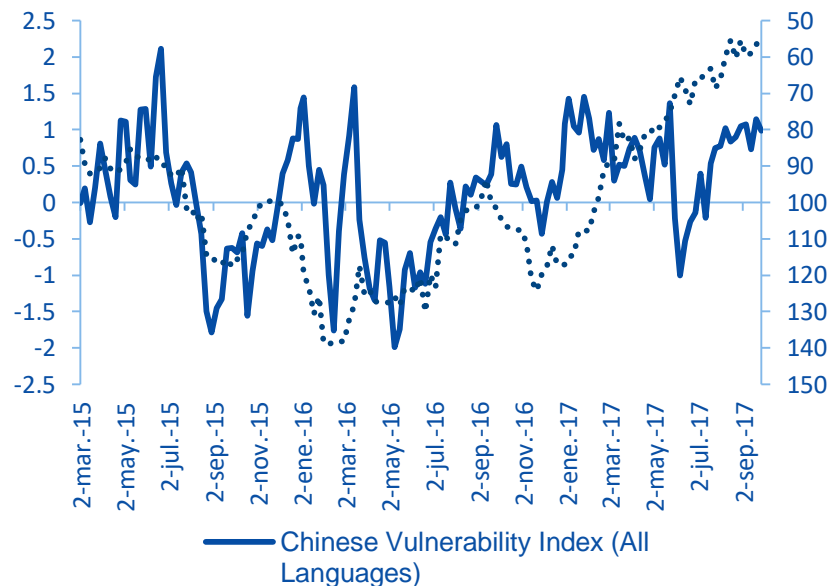
# The CSVI is associated to other High Frequency Indicators as Growth and Market Risk

## CVSI Index and Economic Activity (PMI)



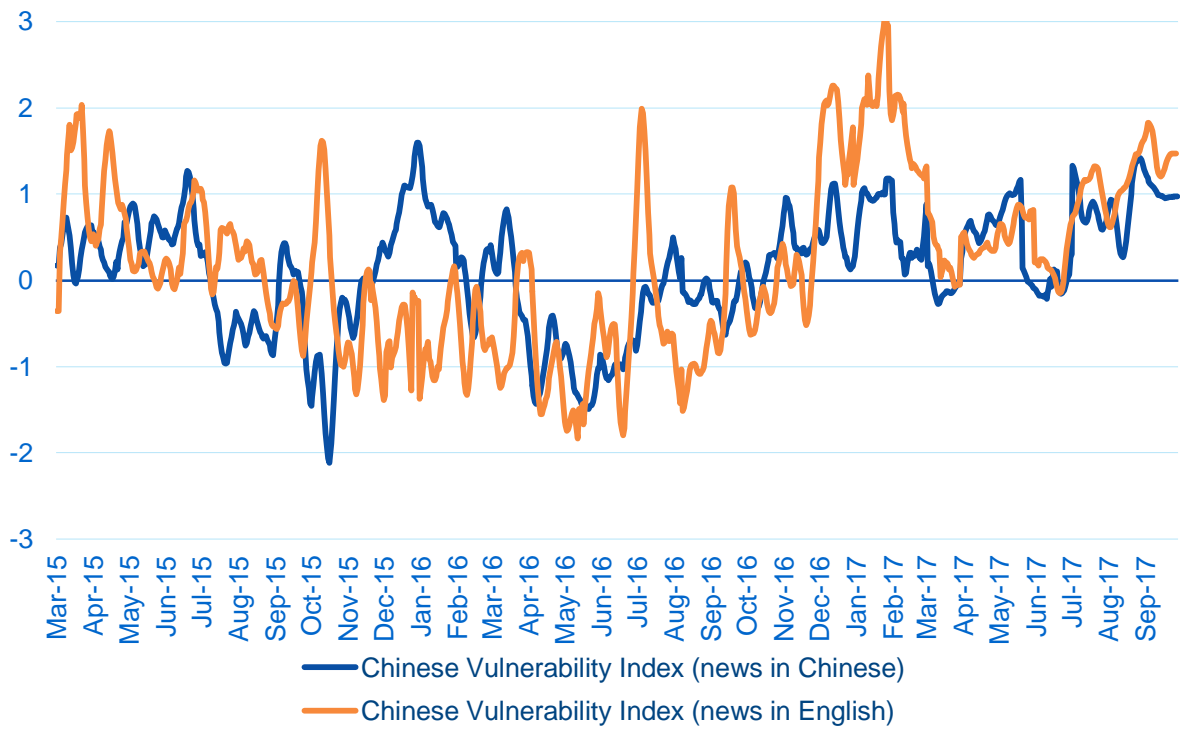
Source: BBVA Research

## CVSI Index and Risk Premia (CDS)



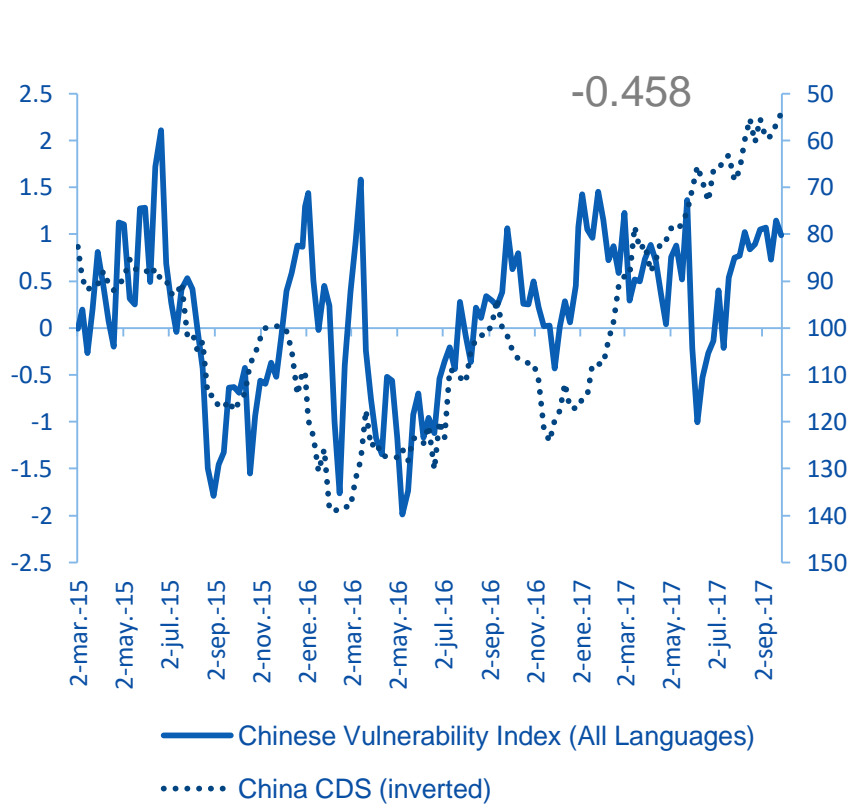
Source:

# Chinese Vulnerability Sentiment Index: total news VS Chinese news



**No Systematic Bias in English & Chinese Language Media**

# No Systematic Language bias but some differences



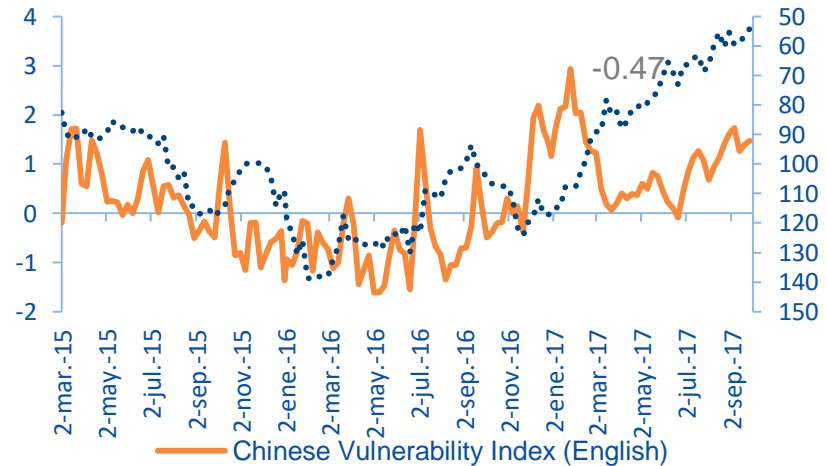
— Chinese Vulnerability Index (All Languages)

..... China CDS (inverted)



— Chinese Vulnerability Index (Chinese)

..... China CDS (inverted)



— Chinese Vulnerability Index (English)

# The ups-and-downs of China's financial vulnerabilites

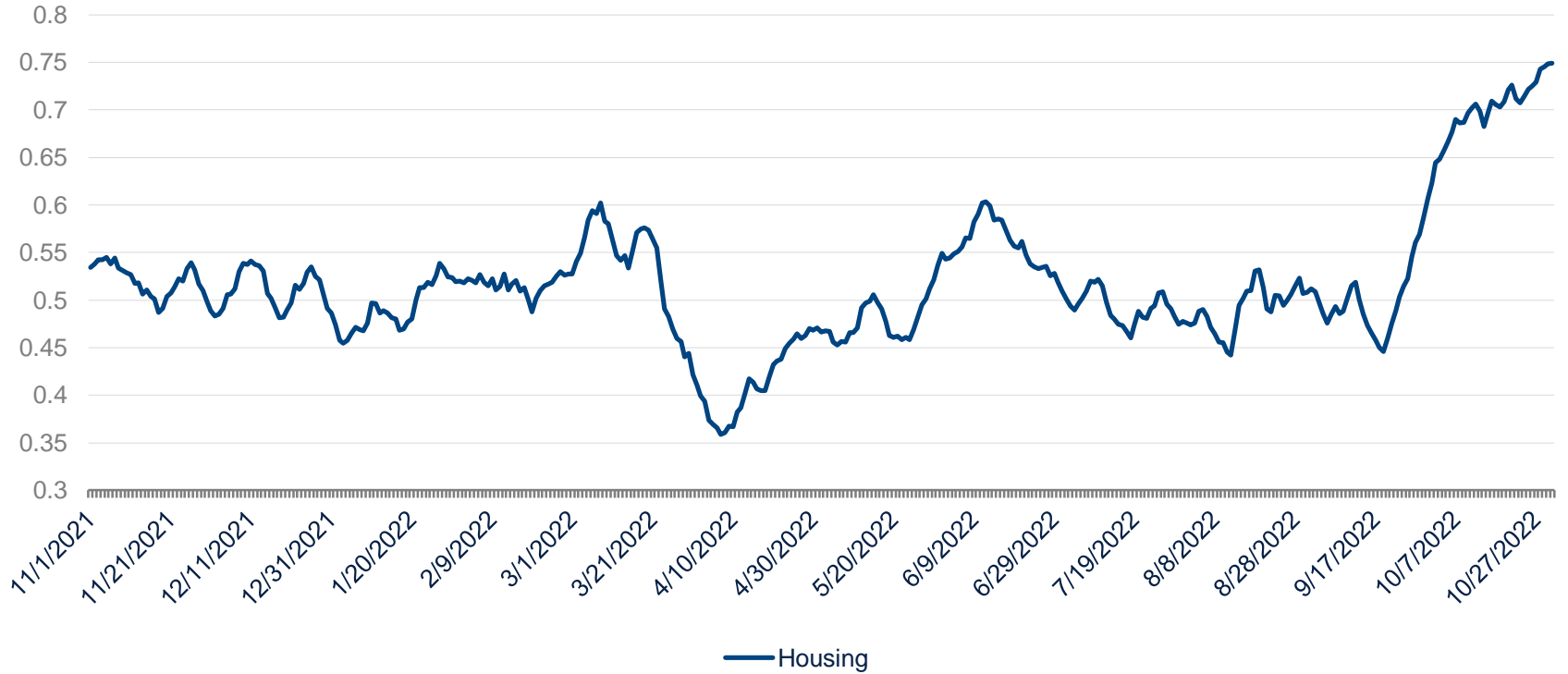




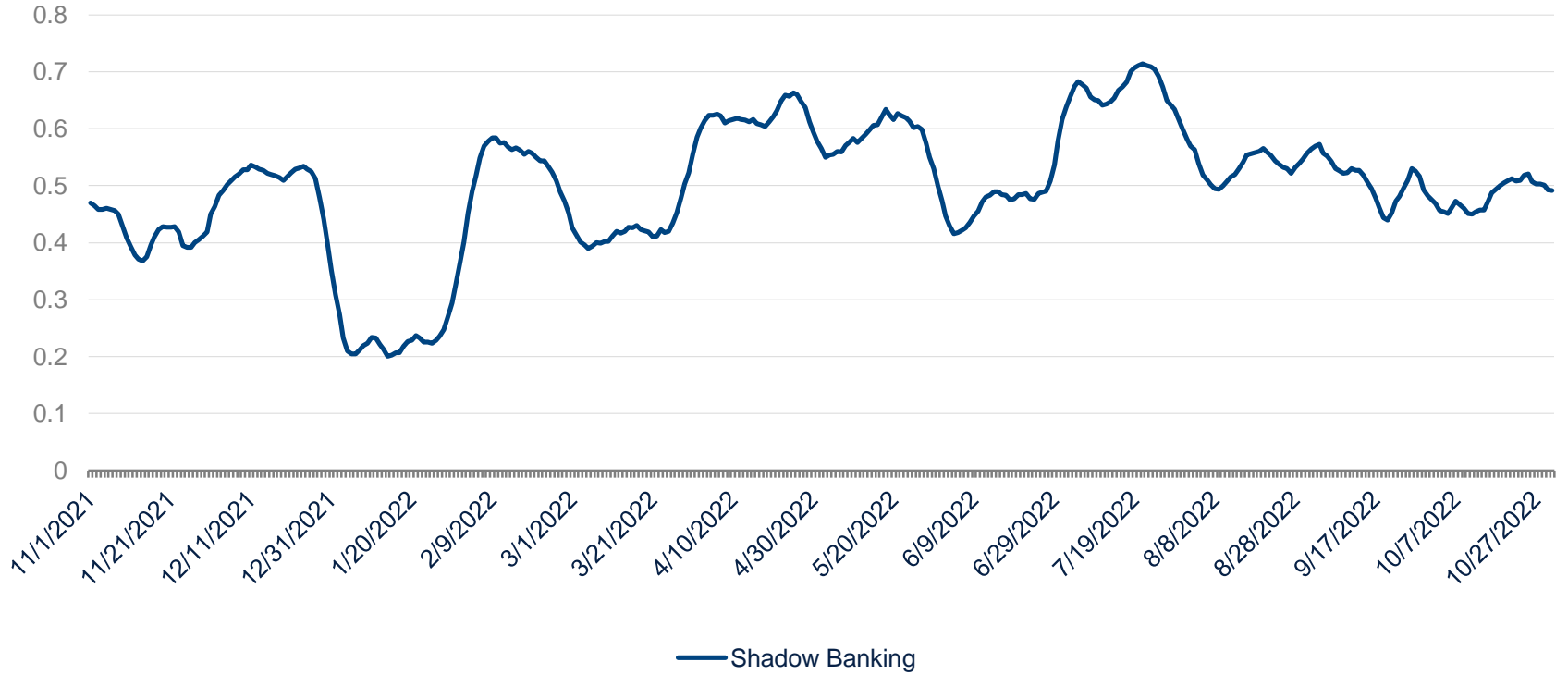
# Subindex: Indebtedness (12M)



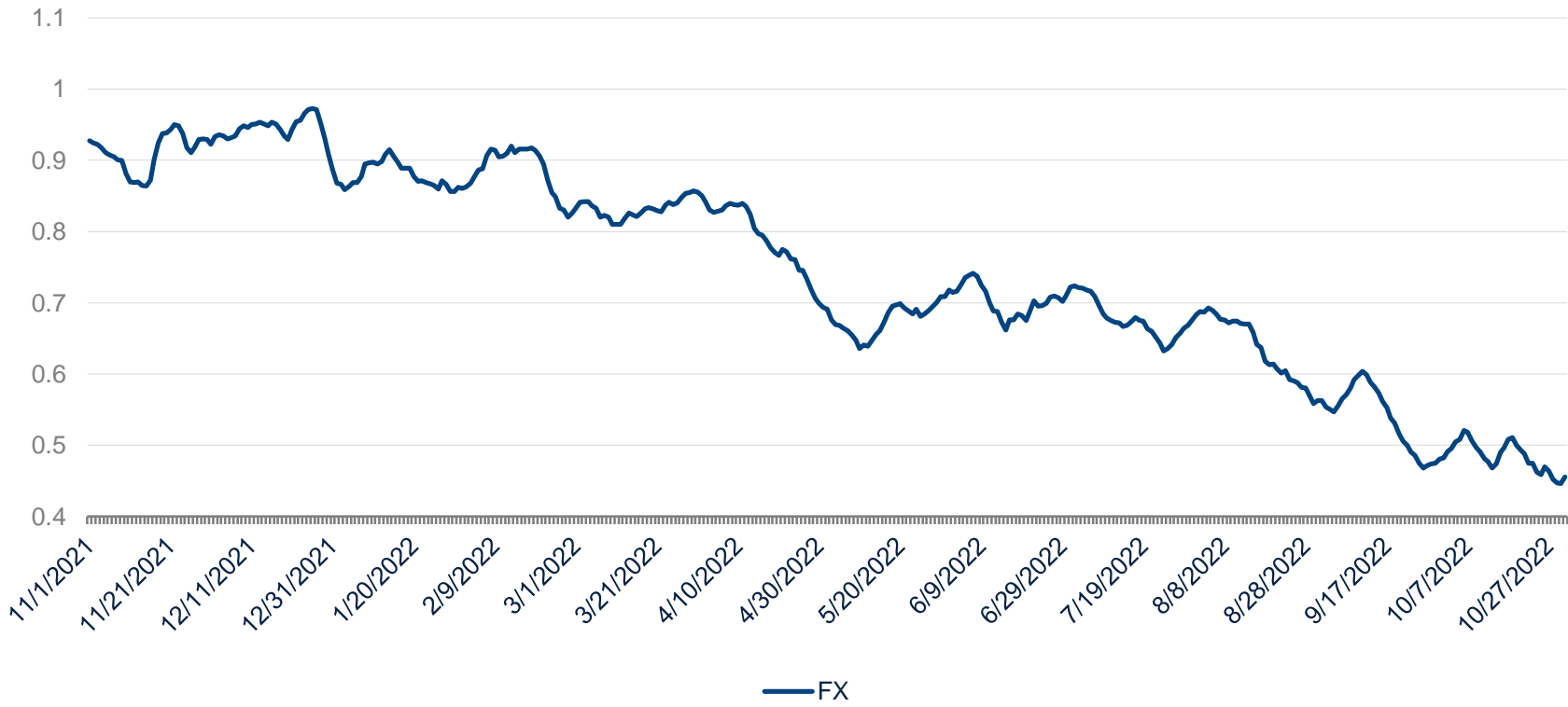
## Subindex: Housing (12M)



## Subindex: Shadow Banking (12M)



# Subindex: FX (12M)



# Thank you!

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Xia Le