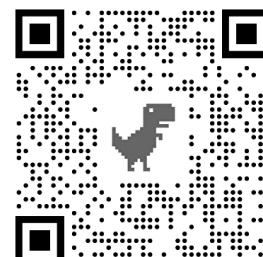


A Multi-Level Sentiment Analysis Framework for Financial Texts

Yiwei Liu, Junbo Wang, Lei Long, Xin Li, Ruiting Ma, Yuankai Wu, Xuebin Chen



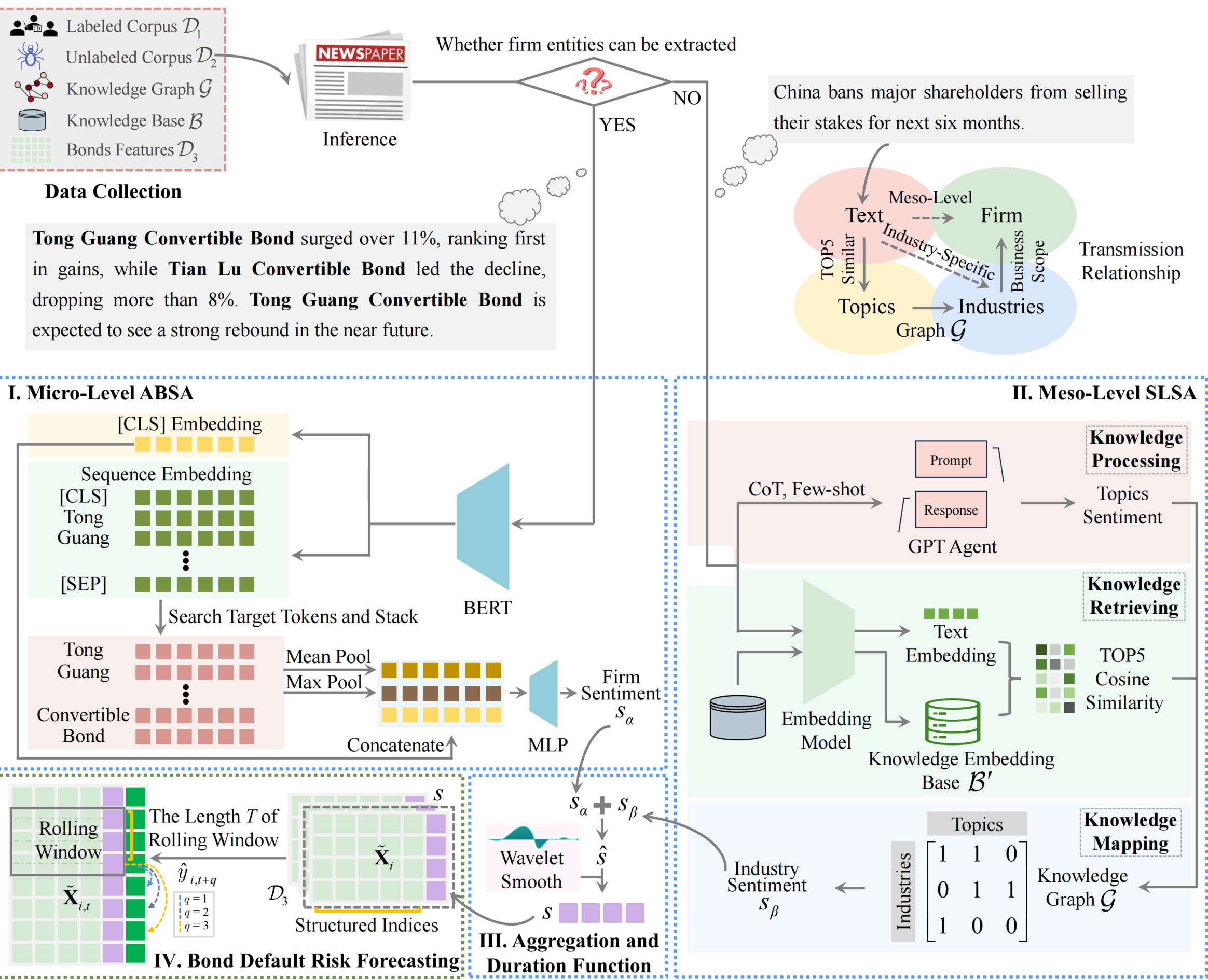
Code Available



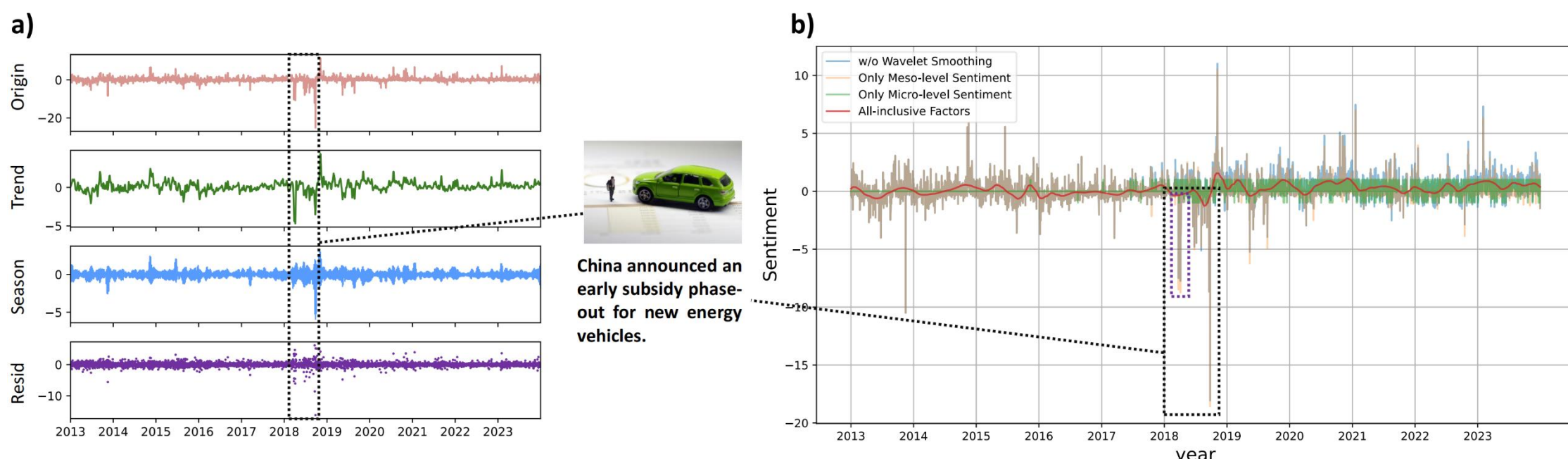
Sentiment analysis for financial market needs to address three questions as below:

- How to precisely analyze the sentiment of entities with different polarities from a **firm-specific** view under subtle and complex contexts within the same text?
- How to derive the sentiment transmitted from the broader industry environment to related firms from an **industry-specific** view?
- How to capture the **duration of text sentiment** by considering its latency and persistence, enabling individual texts to interact with others and diffuse their effect to the entire time series?

Multi-Level Sentiment Analysis Framework



Industry Sentiment Time Series Decomposition of Automobile (2013-2023)



Empirical results on the forecasting target

$t+q$	Sentiment	MAE (e-5)	MAPE (e-3)	p	Δ MAE (%↓)	Δ MAPE (%↓)
$t+1$		11.2366	9.4581	n/a	n/a	n/a
$t+1$	✓	11.3680	8.3686	0.0812	-1.1693	11.5194
$t+2$		8.9683	8.0033	n/a	n/a	n/a
$t+2$	✓	8.6765	7.1257	0.0373	3.2539	10.9658
$t+3$		14.1859	12.4256	n/a	n/a	n/a
$t+3$	✓	14.2665	10.6770	0.0405	-0.5682	14.0730
$t+4$		16.6853	10.4440	n/a	n/a	n/a
$t+4$	✓	16.5656	8.0975	0.0483	0.7170	22.4673

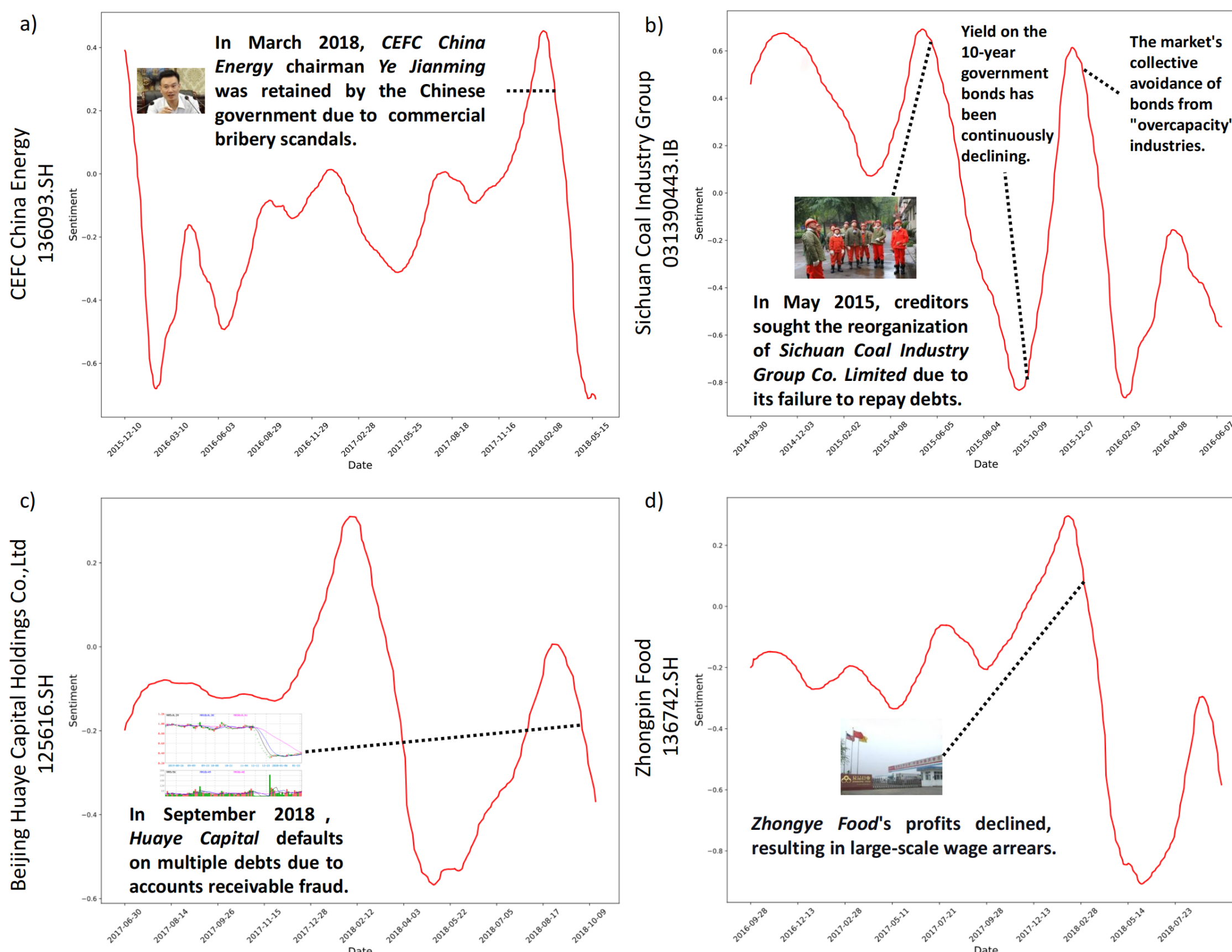
Component ablation results

Micro-Level Sentiment	Meso-Level Sentiment	Duration Function	MAE (e-5)	MAPE (e-3)	p	Δ MAE (%↓)	Δ MAPE (%↓)
			8.9683	8.0033	n/a	n/a	n/a
✓			8.7890	10.0594	0.0573	1.9991	-25.6900
	✓		8.7621	8.0367	0.0472	2.2989	-0.4170
✓	✓		15.567	43.479	≈ 0.0	-73.579	-443.258
*	*		8.9489	8.0205	0.1013	0.2159	-0.2148
✓	✓	✓	8.6765	7.1257	0.0373	3.2539	10.9658

Comparison results of duration function

Duration Function	MAE (e-5)	MAPE (e-3)	p	Δ MAE (%↓)	Δ MAPE (%↓)
n/a	8.9683	8.0033	n/a	n/a	n/a
Smoothing Spline (factor set to 16)	8.7114	8.0536	0.0342	2.8649	-0.6282
Daubechies 4 wavelet (level set to 3)	8.8166	9.3779	0.0457	1.6915	-17.1753
Daubechies 4 wavelet (level set to 6, f_4^*)	8.6765	7.1257	0.0373	3.2539	10.9658

Visualization of sentiment dynamics of defaulted bonds preceding defaults



Experimental results

Sentiment Heatmap for 40 Industries (2013-2023)

