



Interpretable Indicators

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Hack4Good
November 20th, 2019

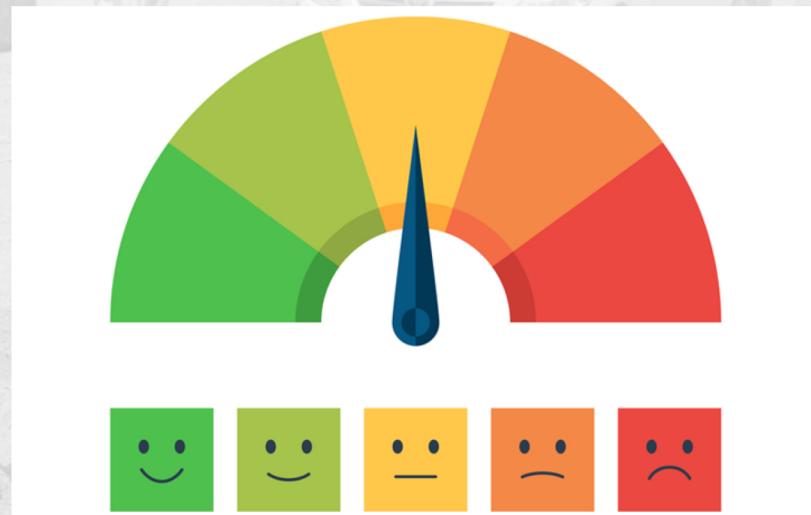
The problem

A lot of
data

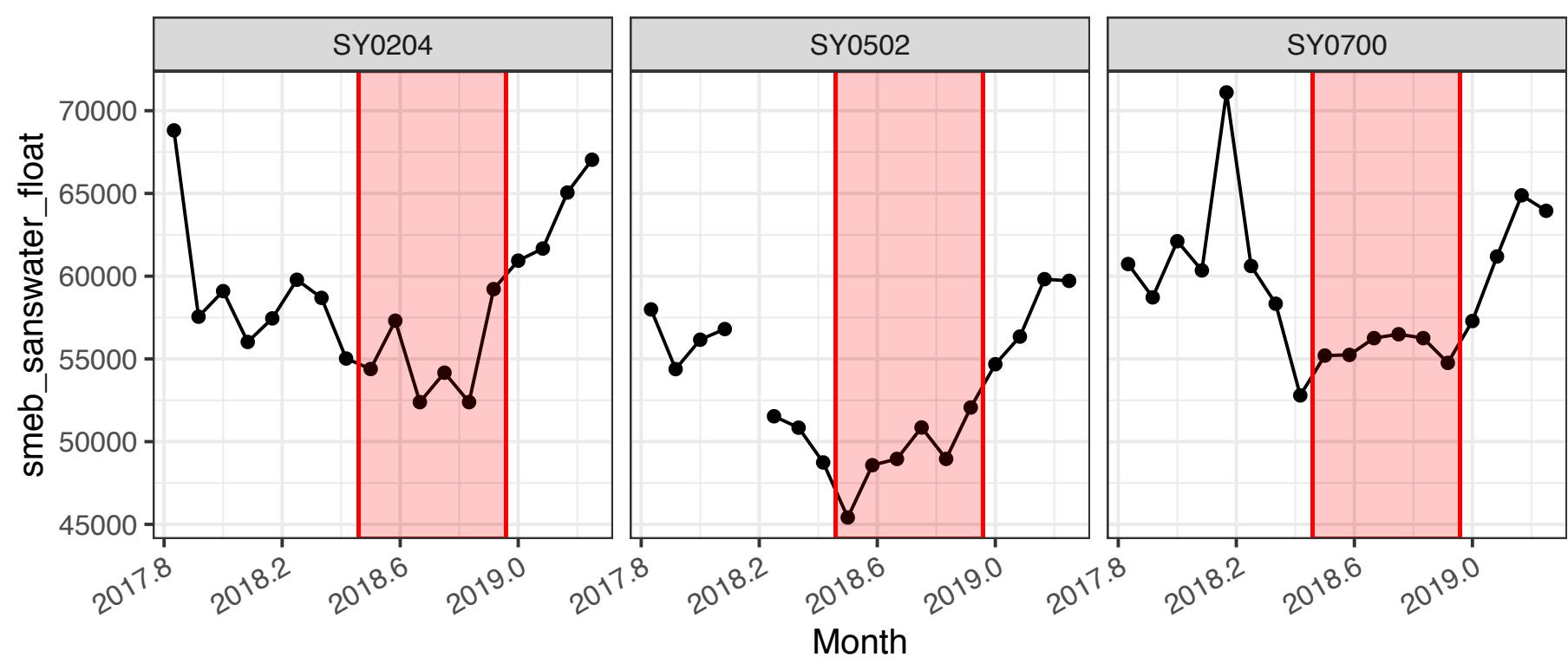
SMEB Costs				
Price_SMEB_total_wfloat	Price_SMEB_total_sanswater	Price_smeb_incomplete	Price_SMEB_usd	
60045	56030	55856	131	
		53543		
		54791		
		54651		
		55281		
66602	64038	61955	127	
68451	66177	63675	125	
66595	64031	61949	121	
		54132		
63839	62950	59386	123	
63482	61049	59059	118	
65000	61956	60472	124	
62845	59942	58460	123	
61341	58923	57062	129	
60245	57826	56042	126	
56509	54000	52567	133	
57957	56176	53514	126	
58163	56596	54105	126	
58939	56166	54827	127	
57592	55173	53574	129	
57987	55229	53941	131	
57752	54802	53723	129	
50971	48794	47415	115	
56224	53176	52301	126	
54723	53030	50905	118	
57320	56110	53321	123	
57970	56035	53926	120	
62410	59653	58056	126	
		0		
56604	52976	52655	119	
57146	53518	53159	118	
		63008		
		64493		
		56285		
	75043	69808		
	64715	60200		
	68013	63268		
	60990	56735		
	65688	61105		
	67116	62740		



Interpretable
Indicators



From price time-series to interpretable indicators

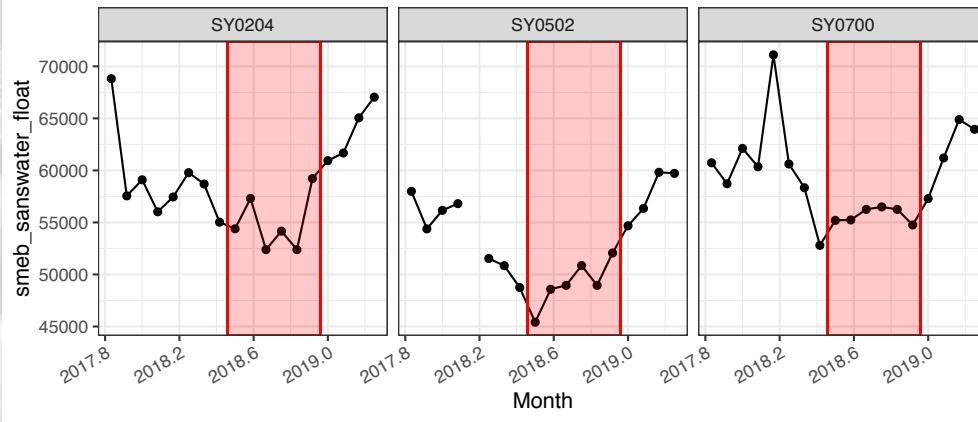




The Framework



Characterizing time-series: volatility, trends, stability



SMEB in three districts

Framework:

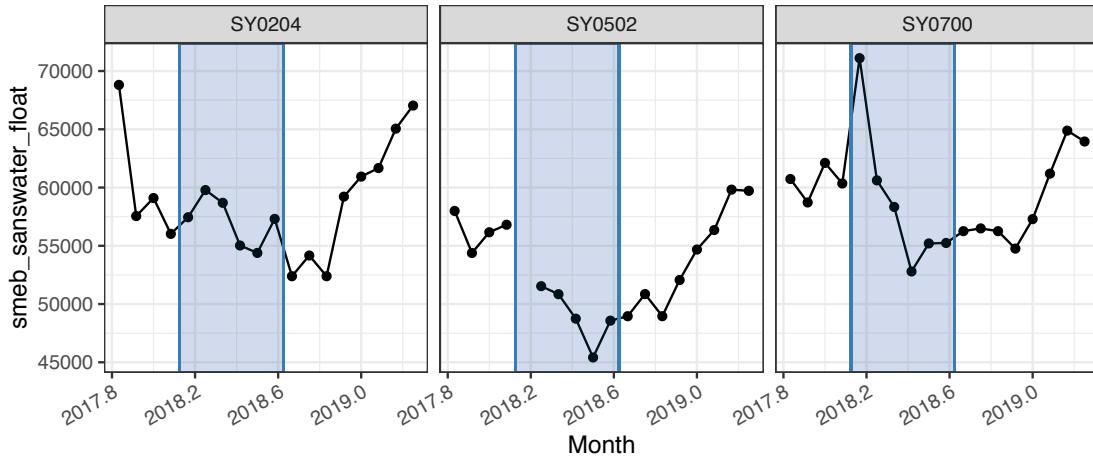
1. Extract time-series within time-window (e.g. 6 months);
2. Calculate derivative as $\Delta_t = \text{price}_t - \text{price}_{t-1}$
3. Assess volatility: $SD(\Delta_t) / \text{mean}(\text{price})$
4. Assess price change: $\text{mean}(\Delta_t) / \text{mean}(\text{price})$

Applications:

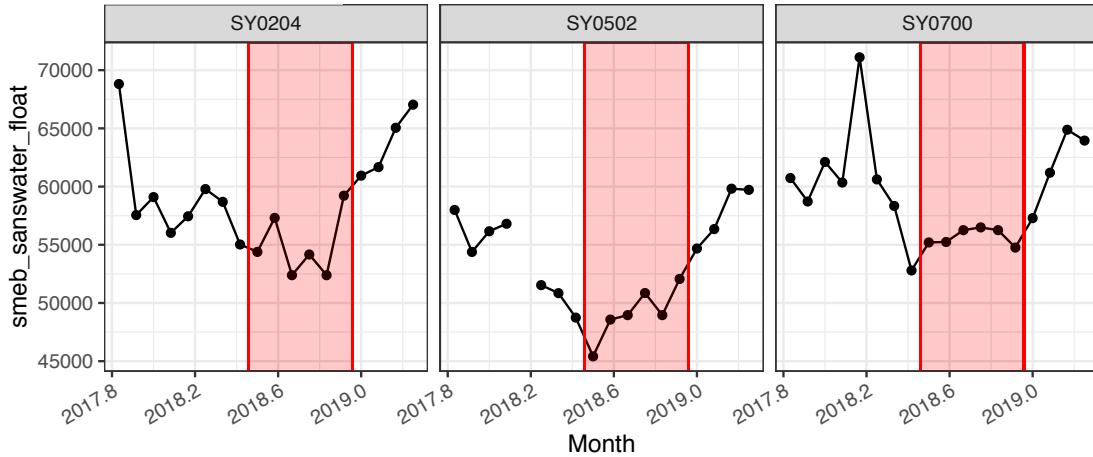
1. Characterize trends in prices
2. Estimate price for the next month

Trend indicators: upward, downward, stable, volatile

August 2018



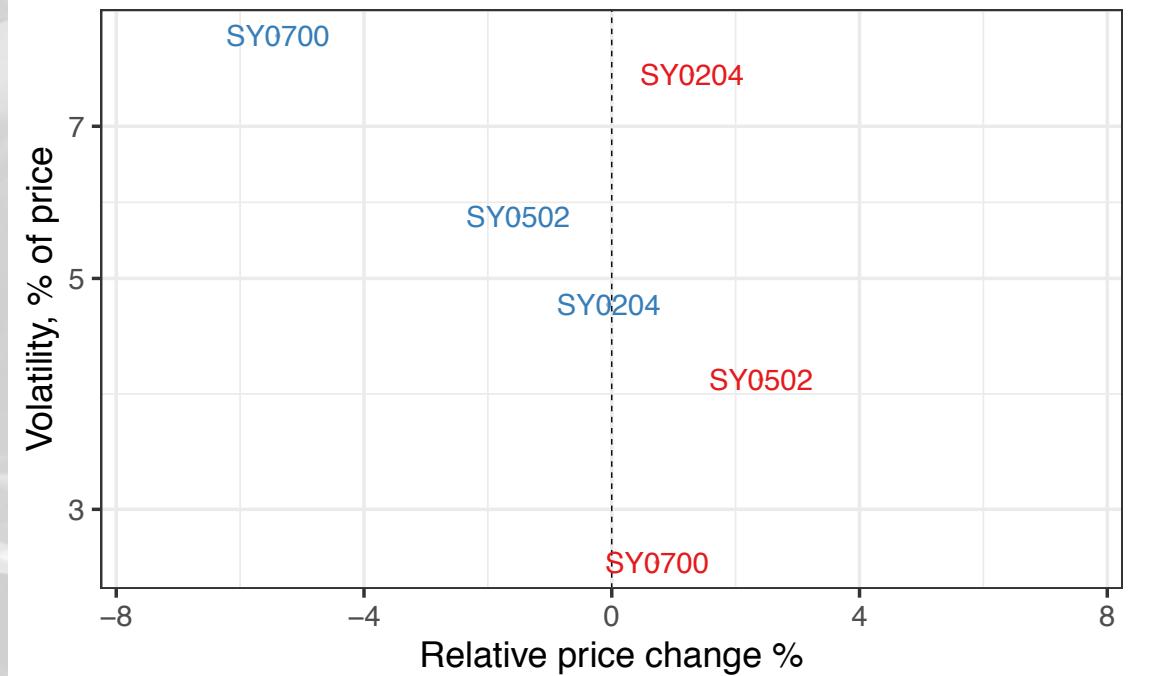
January 2019



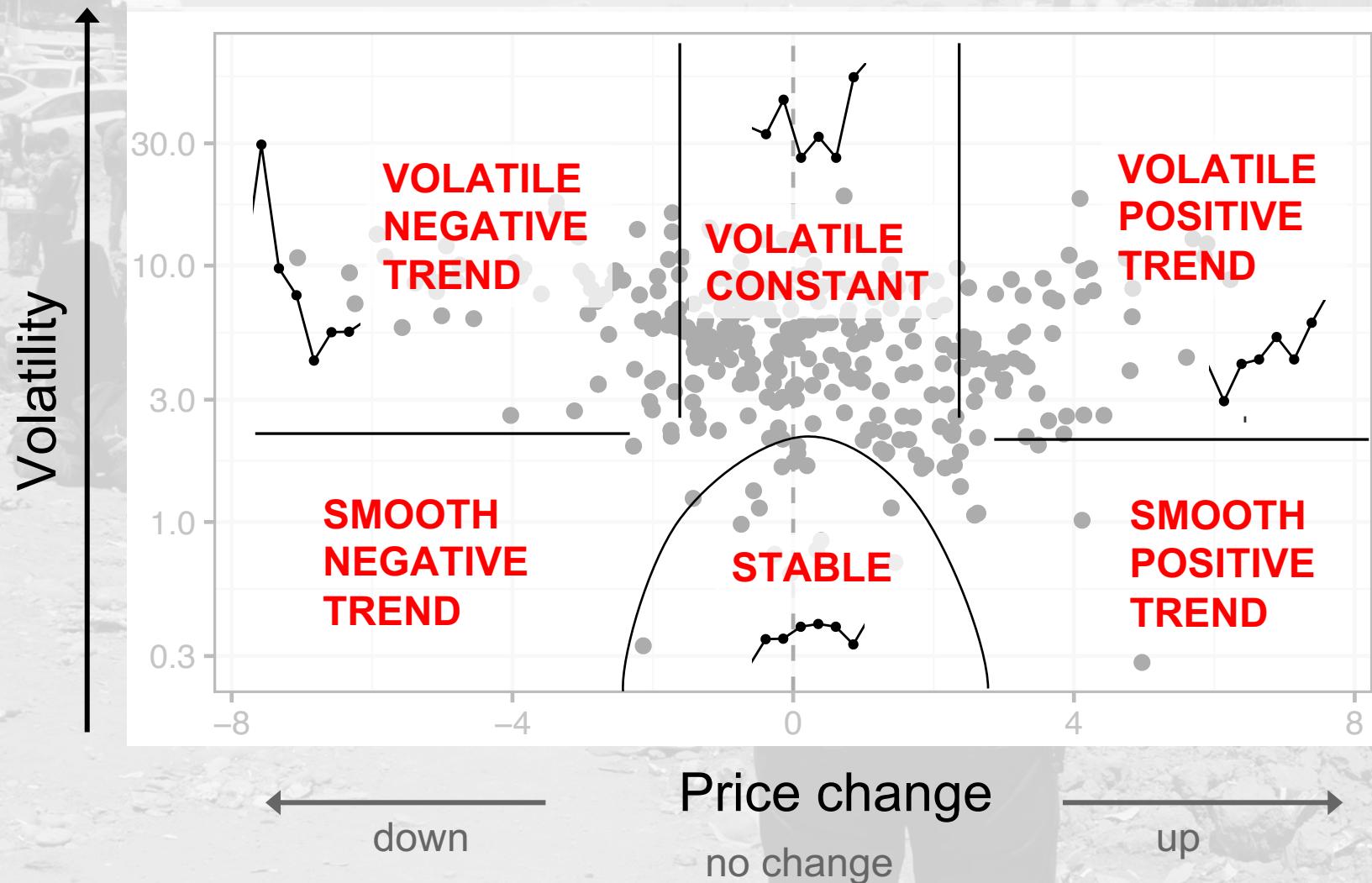
SMEB in three districts

$$\text{Volatility} = SD(\Delta_t)/\text{mean(price)}$$

$$\text{Price_change} = \text{mean}(\Delta_t)/\text{mean(price)}$$



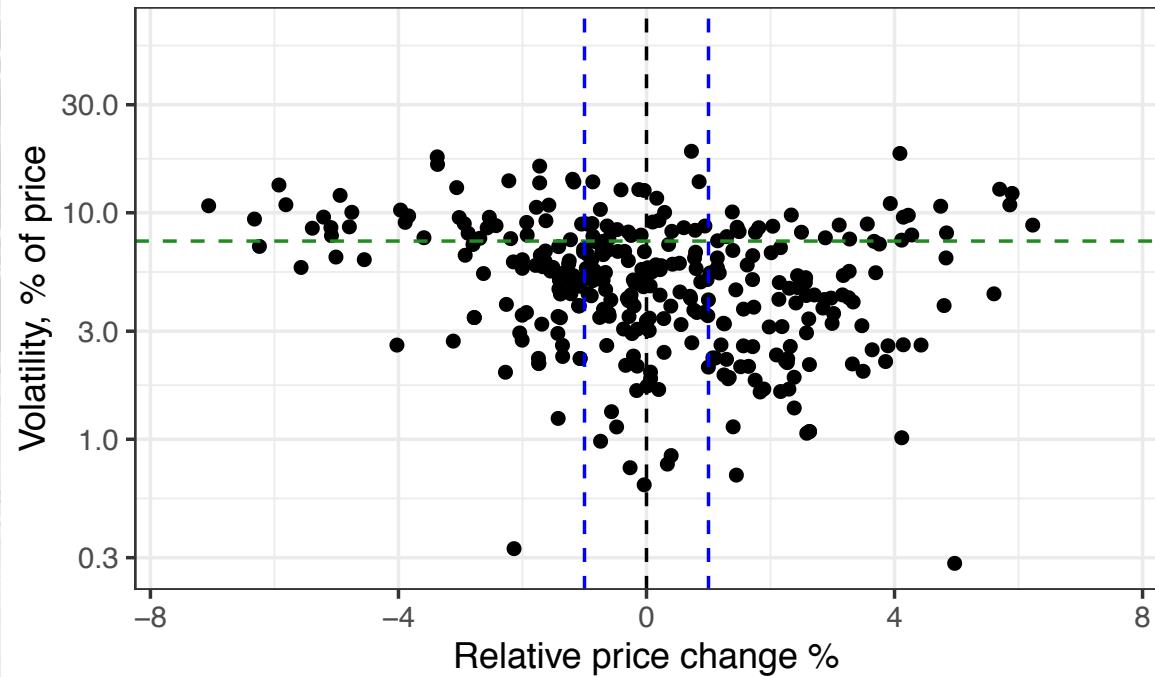
Indicators: assigning the labels



District level: how large are SMEB fluctuations?

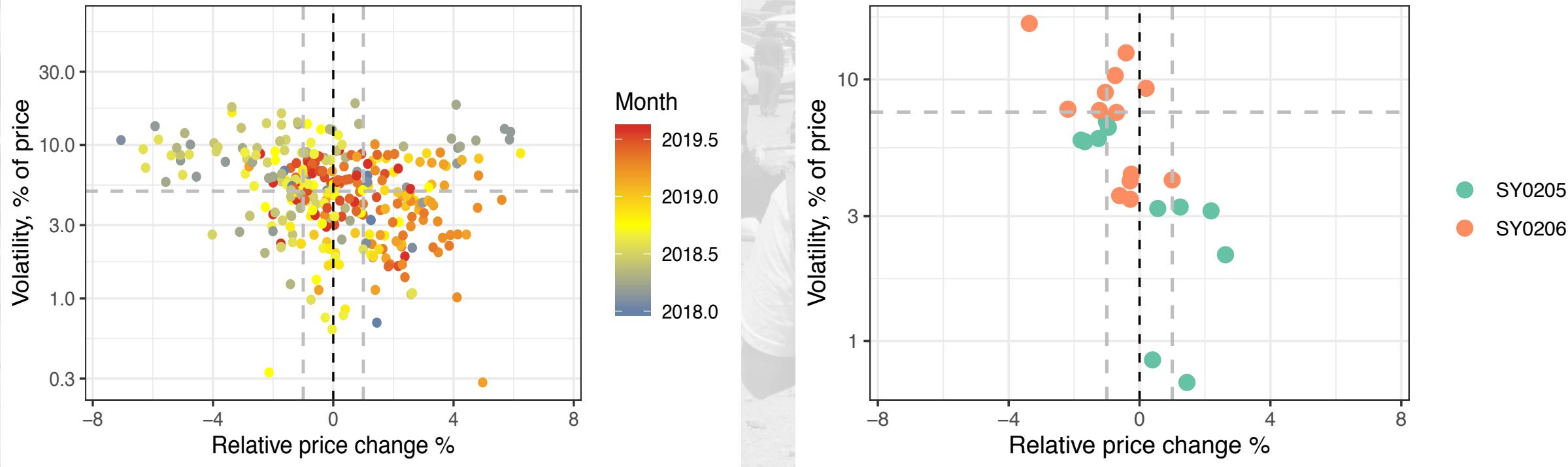
Volatility is typically 3% - 5 %,
rarely more than 10%

6-month window trend mapping



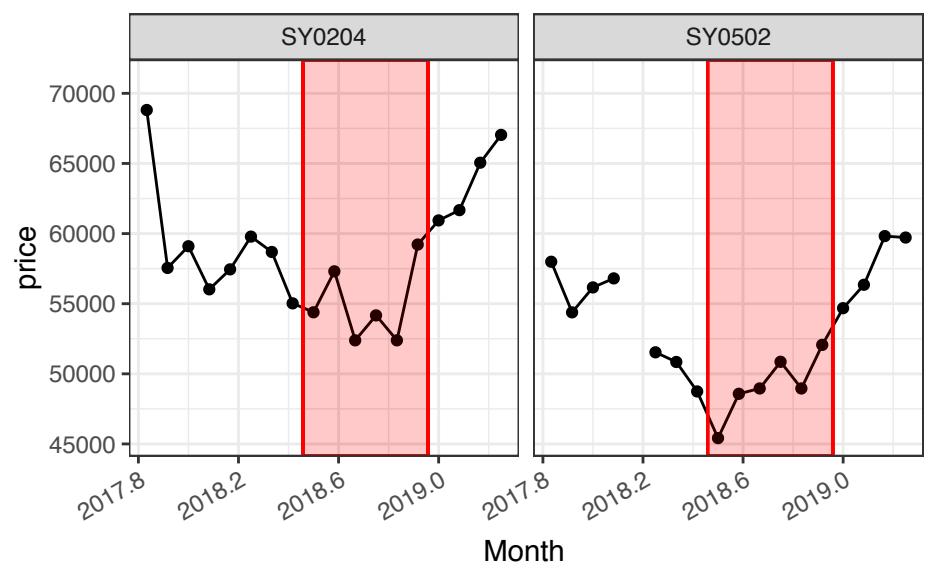
Price changes are contained within 5%

Volatility and trend are both month and location specific



Heuristic: missing volatility and trend can be imputed from month and location averages

Our framework is widely generalizable



Applicable to any:

- geographical level (town, subdistrict etc.)
- time window (min 3 points)
- commodity type (or commodity group)

Framework is transferrable to other crisis areas!

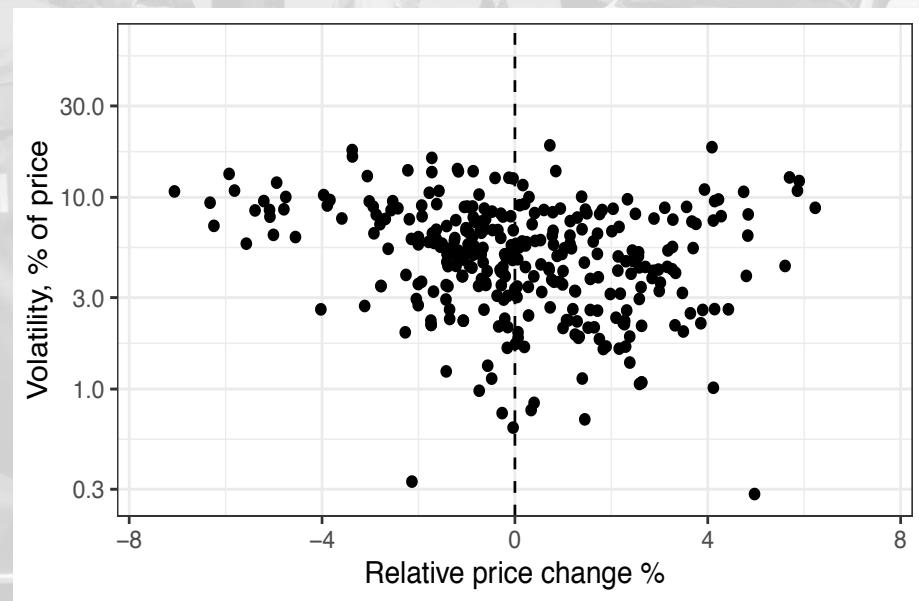
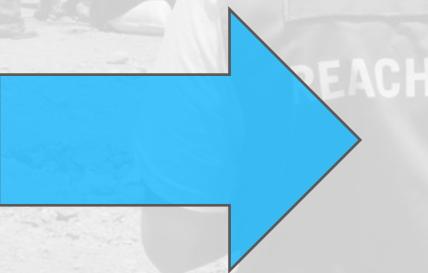
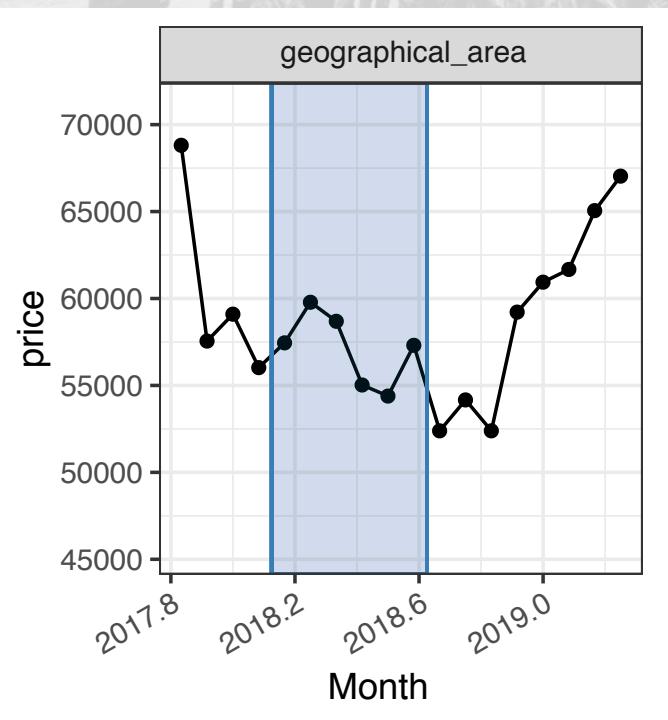


Going Forward



Next applications of the framework

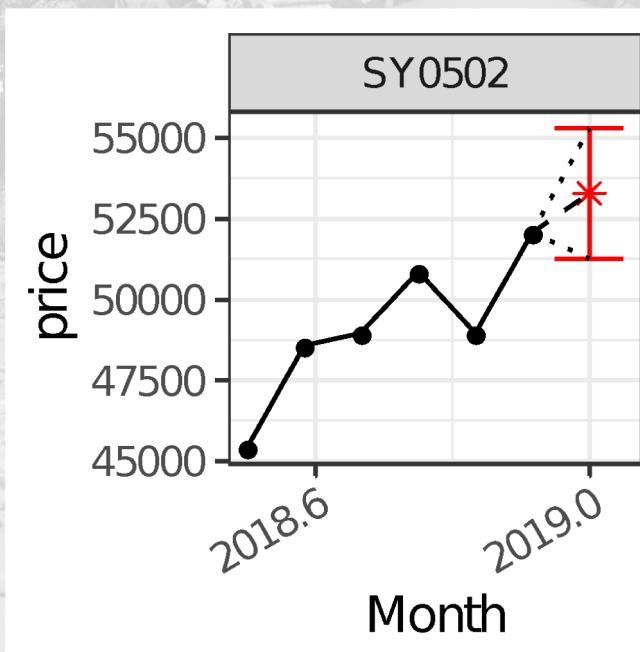
- Repeat the analysis for all commodities, time windows, geographical levels
- Include the next period into the analysis
- Apply to the new crisis area



Outlook

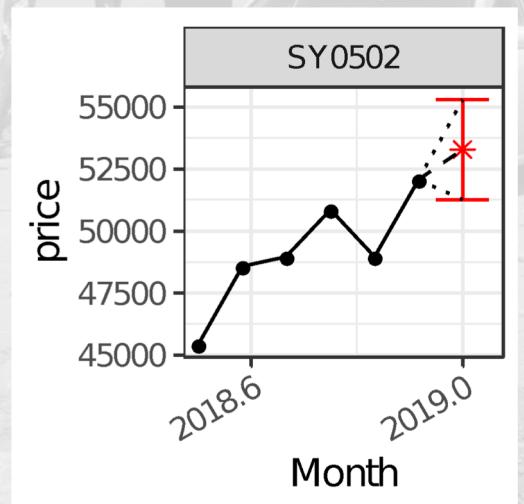
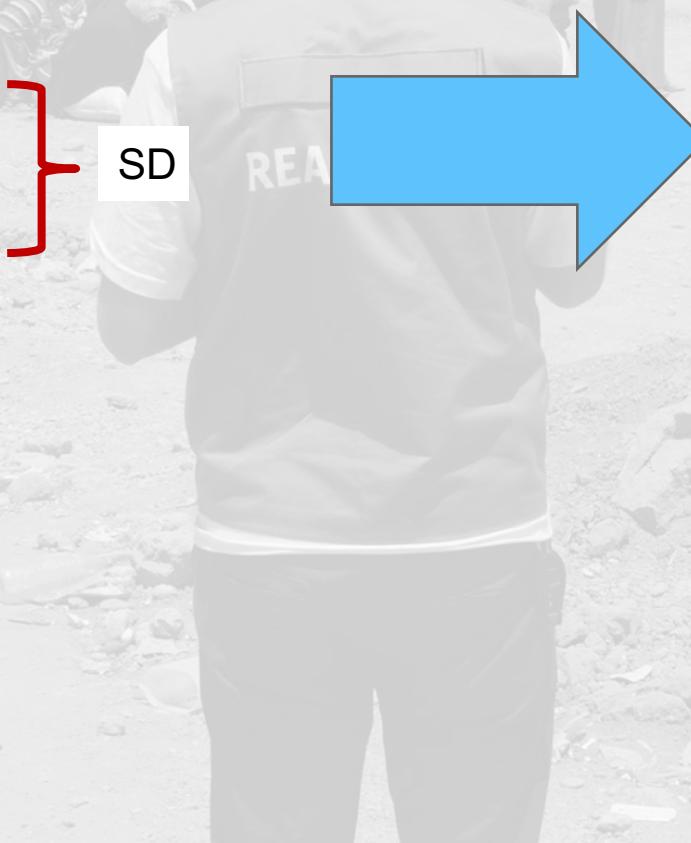
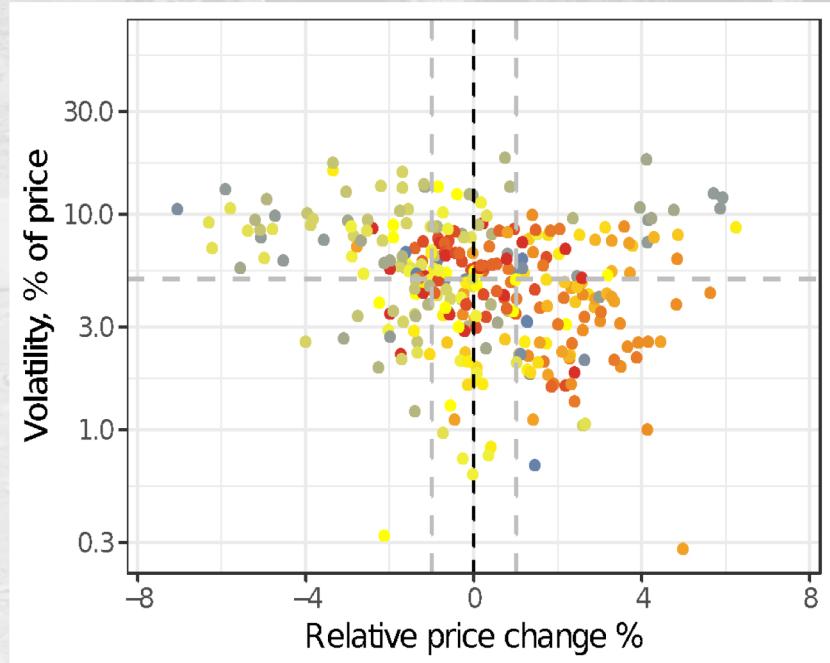
Integrate the work with other teams

- Connect trend analysis with external factors (e.g. war activity)
- Adding fluctuation magnitude (SD) to price prognosis



Summary

Quantitative indicators help with planning



THANK YOU!



IMPACT Shaping practices
Influencing policies
Impacting lives



Amit Gupta
Mentor

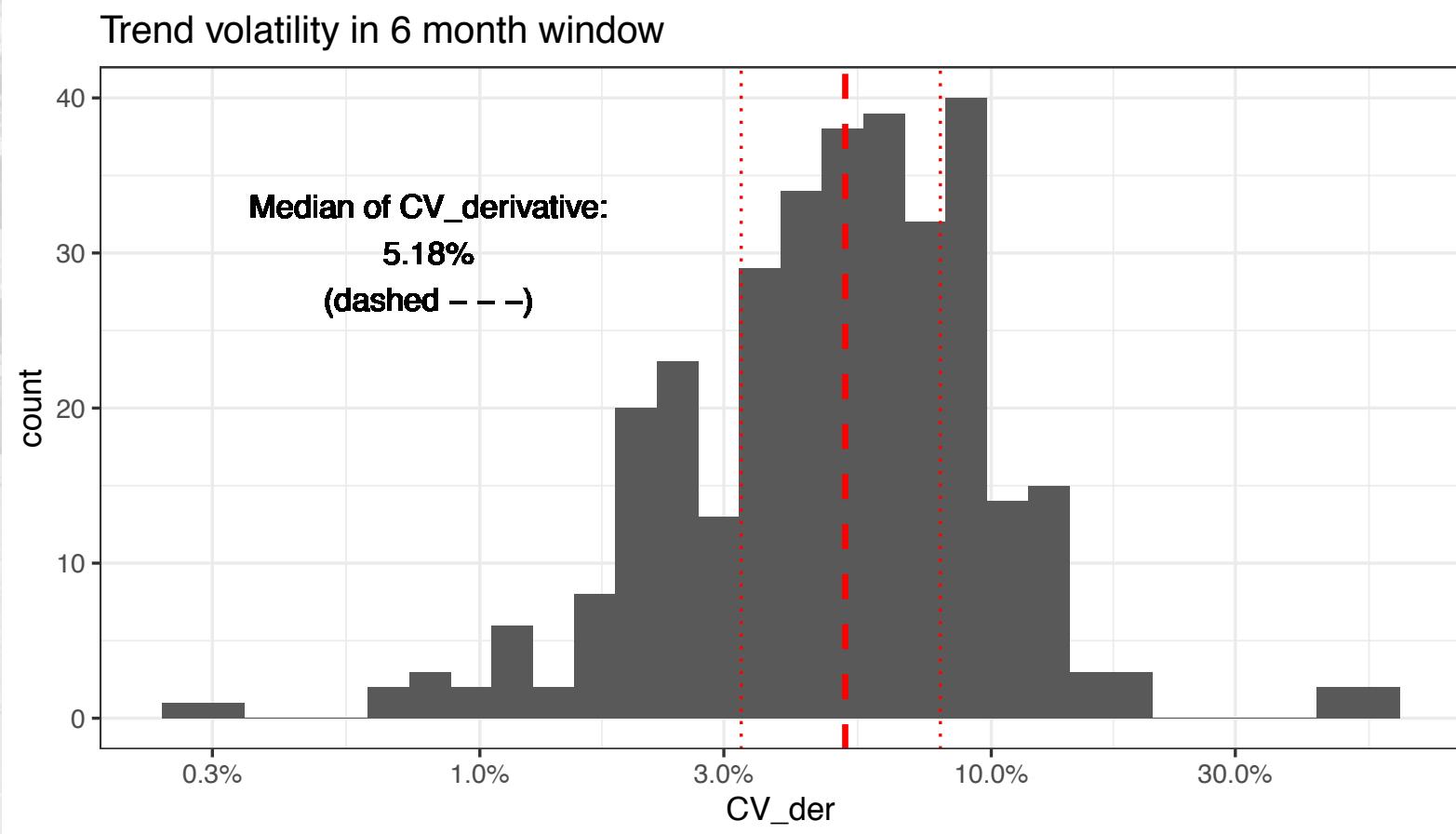


Limitation

Our model requires at least 3 records in each time window

- This is rarely available on subdistrict level and even less so on town level

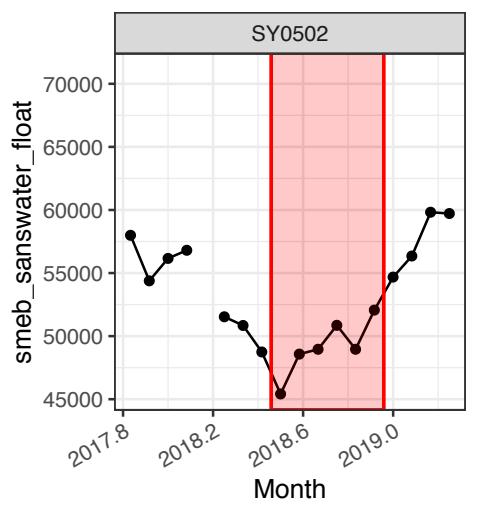
Volatility distribution: fluctuations are limited!



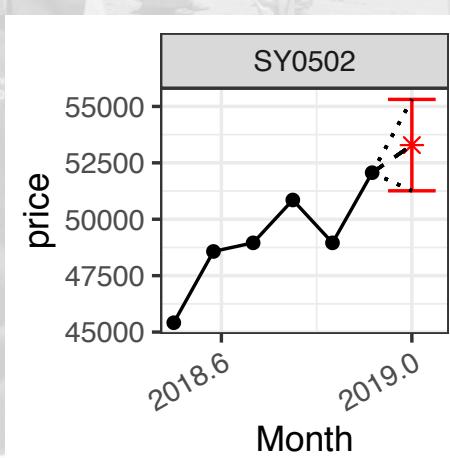
"Confidence interval" for price prediction

Approach:

1. Assess trend ($\text{mean}(\Delta_t)$) and volatility ($SD(\Delta_t)$)
2. Predict price in the next month as $\text{price}_{t+1} = \text{price}_t + \text{mean}(\Delta_t)$
3. Magnitude of volatility allows to predict "confidence interval":



$$\begin{aligned} \text{price}_{\text{Dec}2018} &= 52065 \text{ SYP} \\ \text{mean}(\Delta_{\text{Dec}2018}) &= 1221 \text{ SYP} \\ \text{SD}(\Delta_{\text{Dec}2018}) &= 2026 \text{ SYP} \end{aligned}$$



$$\text{price}_{\text{Jan}2019} = 53286 \pm 2026 \text{ SYP}$$