Stock markets and suicide

Evidence from real-time emergency calls in Istanbul

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November 4, 2026

Motivation

Retail participation:

- On the rise across the globe (WEF, 2023).

Market movements may function as stressors.

- **Wealth.** Drop in equity prices reduce the wealth of households with shares.
- **Expected future utility.** Lower returns reduce expected future utility for households without shares.

This paper

RQ. How do stock market fluctuations relate to suicide in an emerging economy?

We study the relationship using ...

- Ambulance records selected for suicide-related calls on the Anatolian side of Istanbul
  - Call dates and locations
  - Triage
  - Sex and age
- Standardized daily returns on the BIST All Index
  - OLS with daily call counts from 2017 to 2024

Preview of findings

- Lower market returns are associated with more suicide-related emergency calls.
  - A one-standard-deviation decrease in returns is associated with 0.19 more calls per day.
  - The findings suggest the role of both positive and negative returns.

- Extension
  - The demographic comparisons point to males aged 25–44.
  - The relationship is most precisely estimated for cases with higher clinical severity.

Literature

Effects of stock markets:

- Mental and physical health, accidents, and parking violations, among other outcomes (Engelberg and Parsons, 2016; Chen et al., 2012; Giulietti et al., 2020; Siganos, 2022).

Geographic scope:

- With the exception of Taiwan & China, the evidence comes from developed economies (USA, UK, and Japan).

Economic outlook and mental health

- Income expectations and social and economic uncertainty (e.g., Vandoros and Kawachi, 2021)

Roadmap

- Research setting
- Data and methodology
  - Measurement of suicide-related emergency calls
  - Stock market and other variables
  - Methodology
- Results
- Conclusions

Research setting

Turkey as an emerging market:

- Inflation and currency shocks.
- Retail investment in gold, currency-hedged deposits, and equities.

Retail stock market participation:

- Growth in the number of investors, particularly among younger people.
- One in four investors resides in Istanbul (1.59 million in 2025).
- Domestic exposure has more than doubled since 2013, reaching 62.9%.
- Equity market capitalization stood at 20.4% of GDP in 2024.

Suicide-related calls

Source and extent of coverage:

- Obtained from Turkey's public Emergency Medical Services system (*112 Acil Saglik Hizmetleri*).
- Covers the Anatolian part of Istanbul between January 2017-June 2024 (Around 5 mn.).

The data include:

- Date and precise time of over 2.35 million individual ambulance call.
- Patient age, gender, location of the incident, and triage.
- ICD-10 diagnosis assigned by the attending paramedic
- Paramedic free-text clinical notes.

Suicide-related calls (cont.)

Data construction:

- Deduplicated records by call identifier $\times$ hour.
- Identified intentional self-harm using ICD-10 codes X60–X84.
- Screened paramedic notes to confirm cases, using terms for suicide, self-harm, and their variants.
- Excluded accidents, interpersonal violence, homicide, and cases of undetermined intent.
- Clinically trained researchers independently reviewed ambiguous cases and reached decisions by consensus.
- Aggregated **20,502 retained call records** into daily counts.

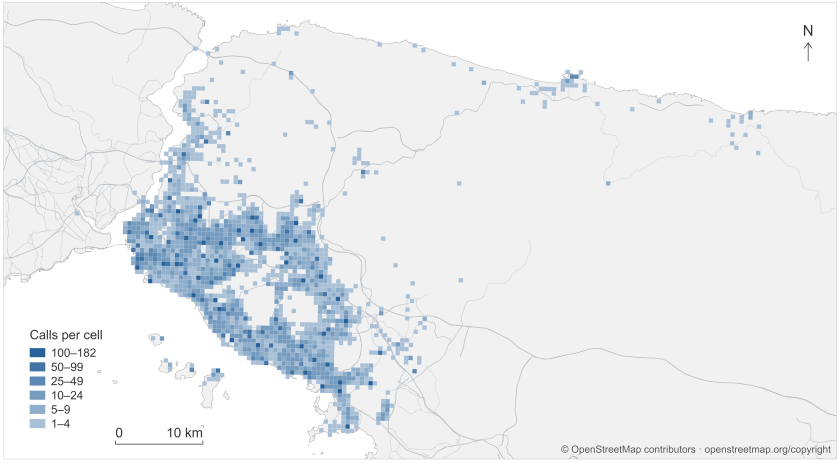


Figure 1: Density of suicide-related emergency calls

Notes: The map shows the density of suicide-related emergency calls from January 1, 2017, to June 30, 2024, using 500 m x 500 m grid cells.

BIST

BIST as main variable of interest:

- Plausible day-to-day financial stress signal.
- **Scaling.** Returns divided by the standard deviation of daily returns over the preceding 365 calendar days.
- **One-day lag.** Each day's ambulance calls are matched to the previous calendar day's scaled return.

We use BIST 100, BIST 50, BIST 30 alternatively.

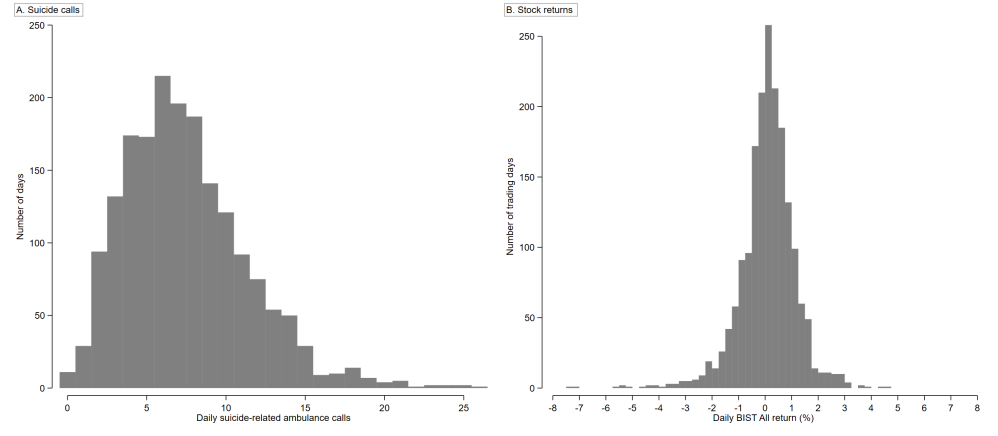


Figure 2: Distribution of daily suicide-related emergency calls and stock market returns

Methodology

$$\text{Calls}_t = \alpha + \beta\,\text{BIST}_{t-1} + \boldsymbol{\delta}\mathbf{X}'_{t-1} + \lambda_{\text{calendar}(t)} + \varepsilon_t$$

- $\mathbf{Calls}_t$ is the number of suicide-related emergency calls on day t.
- $\mathbf{Bist}_{t-1}$ is the All Index return on the preceding calendar day.
- $\mathbf{X}_{t-1}$ includes precipitation, air temperature, and the COVID-19 policy stringency index on the preceding calendar day.
- λ includes day-of-week, day-of-month, month-of-year, and year fixed effects, plus an indicator for days before or after a public holiday.

We report heteroskedasticity-robust standard errors.

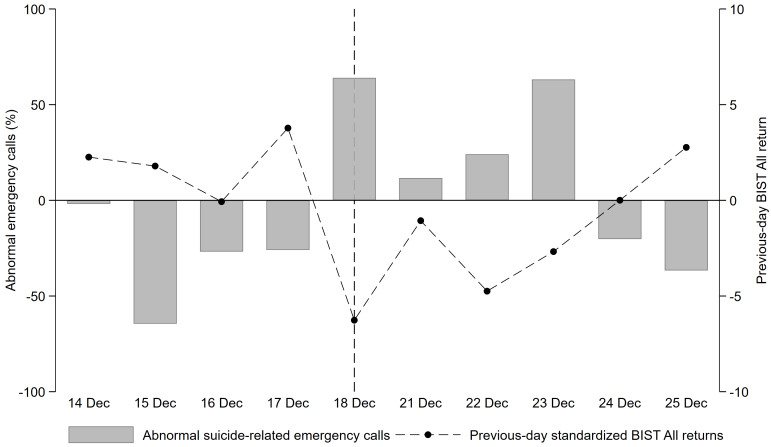


Figure 3: Abnormal suicide-related emergency calls and December 2021 crash

Notes: Abnormal calls are expressed as the percentage deviation of observed from predicted daily calls using OLS with calendar fixed effects.

Table 1: Stock returns and suicide-related emergency calls

	(1)	(2)	(3)	(4)	(5)
BIST returns$_{t-1}$	-0.188**	-0.188**	-0.189**	-0.192**	-0.179*
	(0.070)	(0.070)	(0.069)	(0.072)	(0.074)
Calendar and Holiday FE	YES	YES	YES	YES	YES
Controls	NO	YES	YES	YES	YES
Quadratic Time Trend	NO	NO	YES	YES	YES
Month-by-Year FE	NO	NO	NO	YES	YES
USD/TRY Return	NO	NO	NO	NO	YES
Observations	1,832	1,832	1,832	1,832	1,832
Adjusted R-squared	0.360	0.360	0.380	0.401	0.401

Notes: OLS regression coefficients with heteroskedasticity–robust SE in parentheses.
$^{+}$: $p < 0.10$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$.

Table 2: Tests for nonlinearity

	(1)	(2)	(3)	(4)
BIST return$_{t-1}$	-0.182*			
	(0.072)			
(BIST return$_{t-1}$)^2	0.012			
	(0.025)			
BIST return$_{t-1}$: Bottom tercile		0.357*		0.294
		(0.163)		(0.190)
BIST return$_{t-1}$: Top tercile			-0.272$^+$	-0.126
			(0.156)	(0.182)
p-value: Bottom = Top	NA	NA	NA	0.022
Calendar and Holiday FE	YES	YES	YES	YES
Controls	YES	YES	YES	YES
Observations	1,832	1,832	1,832	1,832
Adjusted R-squared	0.366	0.365	0.364	0.365

Notes: OLS regression coefficients with heteroskedasticity-robust SE in parentheses. $^+$: $p < 0.10$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$.

Results

A one-standard-deviation decrease in BIST All Index is associated with 0.19 more suicide-related ambulance calls the next day.

The other lags show no clear association.

Sensitivity analyses:

- Poisson and negative binomial models
- IHS-transformed call counts and excess calls (5-, 20-, 60-, and 120-day windows)
- Unscaled and IHS-transformed BIST returns
- Alternative BIST indices in the baseline specification

Table 3: Falsification test using future stock returns

	(1)	(2)	(3)
BIST return$_{t+1}$	0.095		
	(0.070)		
BIST return$_{t+2}$		0.086	
		(0.069)	
BIST return$_{t+3}$			-0.001
			(0.070)
Calendar and Holiday FE	YES	YES	YES
Controls	YES	YES	YES
Observations	1,835	1,834	1,834
Adjusted R-squared	0.362	0.374	0.367

Notes: OLS regression coefficients with heteroskedasticity-robust SE in parentheses. $^{+}$: $p < 0.10$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$.

Table 4: Falsification test using international markets

	Taiwan SE			WGI			FTSE 100		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market return$_t$	0.060			-0.060			-0.039		
	(0.073)			(0.073)			(0.073)		
Market return$_{t-1}$		-0.006			0.059			-0.044	
		(0.067)			(0.071)			(0.070)	
Market return$_{t-2}$			0.034			0.040			0.094
			(0.070)			(0.075)			(0.076)
Calendar and Holiday FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,712	1,711	1,715	1,647	1,646	1,646	1,781	1,778	1,781
Adjusted R-squared	0.368	0.366	0.358	0.355	0.363	0.349	0.358	0.359	0.358

Notes: OLS regression coefficients with heteroskedasticity-robust SE in parentheses. The dependent variable is the daily number of suicide-related emergency calls on date t. Columns 1–3 report results for the Taiwan Stock Exchange, Columns 4–6 for the Warsaw Stock Exchange, and Columns 7–9 for the FTSE 100 Index (United Kingdom). $^{+}$: $p < 0.10$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$.

Other falsification test:

- No link between BIST returns and calls for acute appendicitis (ICD10 Code - K35).

Extensions:

- **Clinical severity.** Black, red, yellow, and green triage categories.
- **Sex and age.** By sex, overall and for ages 18–24, 25–44, and 45–64.
- **Location.** Areas with higher and lower socioeconomic development.

Table 5: Effects by gender and age

	Female				Male			
	All	18–24	25–44	45–64	All	18–24	25–44	45–64
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BIST return$_{t-1}$	-0.071	-0.025	-0.008	-0.025	-0.120**	0.009	-0.061*	-0.012
	(0.049)	(0.020)	(0.033)	(0.018)	(0.045)	(0.018)	(0.030)	(0.018)
Calendar and Holiday FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,832	1,832	1,832	1,832	1,832	1,832	1,832	1,832
Adjusted R-squared	0.265	0.083	0.125	0.062	0.228	0.051	0.162	0.062

Notes: OLS regression coefficients with heteroskedasticity-robust SE in parentheses. Columns 1–4 report results for females, and Columns 5–8 report results for males. $^{+}$: $p < 0.10$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$.

Table 6: Effects by socioeconomic development

	SE development	
	High (1)	Low (2)
BIST return$_{t-1}$	-0.135*	-0.055
	(0.054)	(0.037)
Calendar and Holiday FE	YES	YES
Controls	YES	YES
Observations	1,832	1,832
Adjusted R-squared	0.298	0.166

Notes: OLS regression coefficients with heteroskedasticity-robust SE in parentheses. $^{+}$: $p < 0.10$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$.

Table 7: Effects by clinical severity

	Triage			
	Black (1)	Red (2)	Yellow (3)	Green (4)
BIST return$_{t-1}$	0.007	-0.086*	-0.064	-0.040^{+}
	(0.018)	(0.039)	(0.046)	(0.023)
Calendar and Holiday FE	YES	YES	YES	YES
Controls	YES	YES	YES	YES
Observations	1,832	1,832	1,832	1,832
Adjusted R-squared	0.025	0.085	0.397	0.155

Notes: OLS regression coefficients with heteroskedasticity-robust SE in parentheses. In Columns 1–4, the dependent variable is the daily number of suicide-related emergency calls classified into the following triage categories, respectively: black (deceased or expectant patients); red (life-threatening conditions requiring immediate treatment); yellow (conditions requiring urgent care but permitting a delay in treatment); and green (minor conditions requiring minimal treatment). $^{+}$: $p < 0.10$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$.

Conclusion

We link stock markets to real-time suicide-related ambulance calls in Istanbul.

- Stock-market returns are negatively associated with higher suicide-related emergency calls
- This pattern emerges in red-triage calls and in calls involllving males aged 25–44.
- The results from sensitivity analyses and falsification tests are consistent with a causal interpretation.

Limitations:

- No link between ambulance records and individual investor profiles or stockholdings.
- Generalizablity to Turkey or other emerging markets?