PA-RNET: PERTURBATION-AWARE RESIDUAL NETWORK FOR ROBUST MULTIMODAL TIME SERIES FORECASTING

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ABSTRACT

In real-world applications, multimodal time-series forecasting faces a key challenge: textual information is often useful but unreliable. Auxiliary texts may contain irrelevant, ambiguous, incomplete, or structurally corrupted content, making direct text integration prone to introducing noisy semantic signals and degrading forecasting performance. Therefore, robust multimodal forecasting requires a model that can exploit useful textual context while suppressing misleading perturbations. To address this challenge, we propose PA-RNet, a perturbation-aware residual network for robust multimodal time-series forecasting. Before cross-modal fusion, PA-RNet refines numerical features and corrects textual representations to mitigate the influence of perturbations while preserving task-relevant information. It then aligns the refined textual context with temporal patterns in the numerical series, improving forecasting robustness under noisy multimodal inputs. We establish the Lipschitz continuity of PA-RNet with respect to textual embeddings and provide theoretical insights into how perturbation-aware refinement can reduce expected prediction error. We further assess its robustness through supplementary experiments with injected textual perturbations. Results across diverse domains demonstrate that PA-RNet consistently outperforms state-of-the-art baselines while maintaining stable forecasting performance under both original and perturbed textual conditions.[1]

1 INTRODUCTION

Time series forecasting is crucial in various real-world applications where predicting future dynamics is essential. For instance, in energy management, accurate forecasting enables efficient load balancing and demand-response planning Kong et al. (2019); in financial markets, it assists in risk assessment and algorithmic trading strategies Özbayoglu et al. (2020); in healthcare monitoring, predictive models support early diagnosis and timely interventions Xie et al. (2022). and in traffic systems, forecasting traffic flow patterns helps reduce congestion and enhances route planning Yu et al. (2017).

In the era of data abundance, time series data are often accompanied by rich textual context, such as news articles, policy updates, or event descriptions. We refer to this combination as textual-numerical time series. Integrating qualitative context with quantitative data is essential for improved forecasting Zhou et al. (2025), as it enables models to grasp underlying causes and temporal dynamics. For example, aligning stock prices with news can reveal factors driving market volatility Chen et al. (2024), while incorporating weather alerts or event notices can enhance traffic predictions Rodrigues et al. (2019). This paradigm mirrors human reasoning as we combine numerical trends with contextual cues for better-informed decisions.

Existing approaches for text-numerical time series forecasting often depend on carefully curated textual inputs, which are manually crafted or selected with domain-specific knowledge or pre-processed using large language models Kim et al. (2024); Xu et al. (2024); Liu et al. (2024). However, in real-world scenarios, textual information is frequently noisy, redundant, or semantically inconsistent

[1] Code and Datasets are provided in the supplementary materials accompanying this paper.

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Kim et al. (2024), posing significant challenges for accurate forecasting. Most current methods overlook this issue, particularly when the noise varies in intensity or arises from structural inconsistencies.

To address this issue, we focus on robust multimodal time-series forecasting in realistic scenarios where textual information varies in completeness, relevance, and semantic clarity. Although such information can provide valuable context for temporal variations, it may also contain incomplete, irrelevant, ambiguous, or corrupted content. Directly integrating these textual embeddings can introduce unreliable semantic signals and compromise forecasting performance. We therefore propose PA-RNet, a perturbation-aware residual network designed to exploit useful textual context while mitigating the influence of noisy or misleading information.

PA-RNet refines numerical and textual representations before cross-modal fusion. The numerical branch adaptively modulates feature contributions through gating, while the textual branch learns task-dependent semantic corrections within a causal residual structure. Specifically, the learned corrections are added to the original textual representations, allowing the model to adjust potentially misleading features while retaining direct access to the input information. This residual refinement is intended to reduce sensitivity to textual perturbations and support the extraction of predictive contextual cues. The resulting representations are integrated through cross-modal attention to emphasize textual information relevant to numerical dynamics.

The main contributions of this paper are summarized as follows:

- We propose PA-RNet, a perturbation-aware residual network for robust multimodal time-series forecasting. PA-RNet learns task-dependent residual corrections to refine multimodal representations, enabling effective use of informative textual context while mitigating the influence of unreliable semantic information.
- We establish the Lipschitz continuity of PA-RNet with respect to textual embeddings, providing a formal characterization of its sensitivity to textual variations. We further analyze the role of causal semantic correction in reducing the expected prediction error under textual perturbations, offering theoretical support for the proposed residual refinement mechanism.
- Extensive experiments on benchmark textual-numerical time-series datasets demonstrate that PA-RNet achieves competitive overall performance under both original textual conditions and controlled perturbations of varying intensity, supporting its effectiveness and robustness in multimodal forecasting.

2 Related Work

In the domain of unimodal time series forecasting, early statistical approaches have addressed robustness against outliers and noise. For example, Connor et al. (1994) and Gelper et al. (2010) proposed robust forecasting methods in 1994 and 2010, respectively, aiming to improve model stability in the presence of anomalous observations. With the rise of deep learning, time series perturbation modeling has expanded to cover adversarial attacks and noise-aware learning. Yoon et al. Yoon et al. (2022) introduced a robust probabilistic forecasting framework by extending traditional notions of adversarial robustness and distributional stability to the probabilistic setting, and employed randomized smoothing to construct predictors with theoretical robustness guarantees. Overall, the field of unimodal time series forecasting has established a comprehensive set of robustness modeling techniques—ranging from classical robust estimators to modern adversarial defenses.

In multimodal time series forecasting, textual inputs provide rich semantic context but may also contain noise, redundancy, and misleading information. Existing studies have explored text refinement and selection to improve the quality and relevance of contextual information Jiang et al. (2025); Wang et al. (2024). Alongside these efforts, an important consideration is how forecasting models handle unreliable signals in the resulting textual representations. This motivates a complementary focus on representation-level robustness: mitigating the influence of textual perturbations within the forecasting architecture while preserving useful contextual information. Following this perspective, PA-RNet incorporates perturbation-aware residual refinement to learn task-dependent corrections to textual representations and align the refined features with temporal dynamics, aiming to support reliable forecasting under noisy textual conditions.

Related studies have explored diverse strategies for incorporating textual information into time series modeling. Context is Key Williams et al. (2024) introduces a benchmark for forecasting with essential textual context and investigates prompting-based approaches, while Time-LLM Jin et al. (2024) combines time series reprogramming with Prompt-as-Prefix to adapt pretrained language models for forecasting. GPT4MTS Jia et al. (2024) incorporates textual embeddings as soft prompts alongside numerical inputs, whereas DualTime Zhang et al. (2024a) employs dual adapters to learn complementary temporal and textual representations. Other frameworks extend numerical forecasting models to multimodal settings: TaTS Li et al. (2026) treats paired textual representations as auxiliary time series variables, and MM-TSFlib Liu et al. (2024) models numerical and textual inputs separately before combining their outputs through learnable weighting. Although these approaches facilitate the use of textual context, effective multimodal integration does not by itself establish an explicit bound on the influence of textual perturbations on forecasting outputs. PA-RNet addresses this issue through perturbation-aware residual refinement at the embedding level, aiming to preserve useful contextual information while mitigating misleading semantic signals. The refined representations are subsequently aligned with temporal features through cross-modal attention. We further establish the Lipschitz continuity of PA-RNet with respect to textual embeddings, providing a theoretical bound on prediction changes induced by embedding perturbations.

3 The PA-RNet Architecture

This section begins by formally defining the task of multimodal time series forecasting under textual perturbations. We then present the architecture and core components of the proposed model, followed by a theoretical analysis that establishes key properties, thereby providing a solid foundation for the model's robustness and interpretability.

3.1 Problem Setting

Let $D = \{([x_1, s_1], \ldots, [x_n, s_n])\}$ be a textual-numerical time series dataset, where $x_t \in \mathbb{R}$ (for $1 \leq t \leq n$) denotes the numerical value at timestamp t, and $s_t \in \mathcal{S}$ represents the textual summary associated with timestamp t. The total sequence length is n.

Given a lookback window of length L, we observe a sequence of paired inputs $\{([x_1, s_1], \ldots, [x_L, s_L])\}$, and aim to predict the next T future values $[x_{L+1}], \ldots, [x_{L+T}]$. This task requires learning a mapping function:

$$f : ([x_1, s_1], \ldots, [x_L, s_L]) \mapsto (x_{L+1}, \ldots, x_{L+T}),$$

which captures the temporal dynamics of numerical values along with contextual signals from dynamic textual descriptions. To simulate real-world noise, we introduce controlled perturbations Zhang et al. (2024b). Given a ratio $\rho \in [0, 1]$, we randomly corrupt $\lfloor \rho \cdot L \rfloor$ of the past textual inputs $s_1, \ldots, s_L$ using strategies such as irrelevant phrase insertion, token shuffling, or contradiction injection. These perturbations introduce semantic distortions (see Figure 1), allowing us to assess the model's robustness under noisy textual conditions.

3.2 Perturbation-aware Forecasting Framework

As illustrated in Figure 1, PA-RNet integrates modality-specific refinement with cross-modal fusion to support robust multimodal time-series forecasting. Its architecture comprises a perturbation-aware numerical projection module, a causal semantic correction module, a cross-modal attention mechanism, and a forecasting backbone. These components are designed to mitigate the impact of unreliable textual information on forecasting while capturing complementary information across numerical and textual modalities.

The two refinement modules address the distinct characteristics of numerical and textual perturbations. For numerical inputs, the perturbation-aware projection module learns candidate perturbation representations from observed time-series values and incorporates them as residual adjustments controlled by a learnable gate. Together with layer normalization, this adaptive adjustment promotes more stable numerical representations. For textual inputs, the causal semantic correction module uses parameter-free causal attention to contextualize each embedding with its preceding context. A

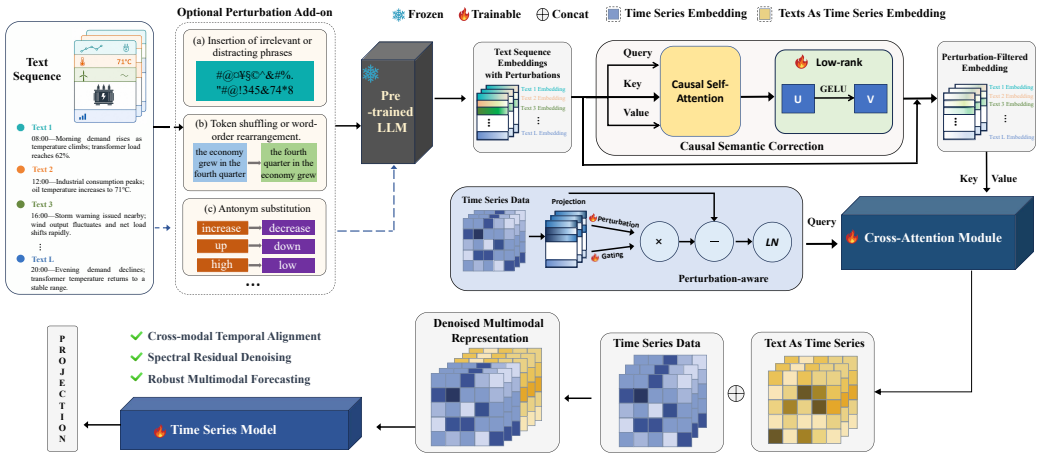

Figure 1: Overview of the PA-RNet architecture, highlighting the numerical perturbation-aware projection module, causal semantic correction module, and cross-modal attention mechanism.

learnable low-rank correction draws on this contextual information to attenuate unstable semantic components, while a residual connection retains the original embedding.

Cross-modal attention connects the refined numerical and textual representations, with a learnable relative position bias supporting the alignment of textual semantics with temporal dynamics. To combine multimodal context with direct numerical information, the forecasting backbone takes the concatenation of the fused representation and the numerical input to generate the final predictions.

3.3 Theoretical Foundations

For notational convenience, let $x \in \mathbb{R}^{B\times L\times 1}$ denote the observed time-series values, where B is the batch size and L is the lookback window length. Let $E \in \mathbb{R}^{B\times L\times D}$ denote the textual embeddings, where D is the embedding dimension. As illustrated in Figure 1, we define the proposed model as

$$f(x, E) = F\left(x \parallel A\left(\widetilde{x}, \widetilde{E}\right)\right),$$

where

$$\widetilde{x} = \mathrm{LN}\left(x - \sigma(\Gamma_x(x)) \cdot \Phi_x(x)\right),$$

In this equation, $\Phi_x(\cdot)$ denotes the numerical perturbation branch, which is implemented by a fully connected network to extract perturbation-related components from the time-series modality. $\Gamma_x(\cdot)$ represents a learnable gating branch, and the Sigmoid function $\sigma(\cdot)$ generates gating weights to adaptively control the contribution of the projected perturbation components. For simplicity, the numerical input x is first mapped into a higher-dimensional latent space through a projection layer before being fed into these branches.

Similarly, the textual embedding is refined via the causal semantic correction module as:

$$\widetilde{E} = E + \mathrm{GELU}\left(\left(\mathrm{softmax}\left(\frac{EE^\top}{\sqrt{D}} + M\right)E\right)U\right)V,$$

Here, $EE^\top$ captures semantic similarities across time steps, while the causal mask $M \in \mathbb{R}^{L\times L}$, with $-\infty$ above the main diagonal and 0 elsewhere, constrains contextual aggregation to the current and preceding positions. The learnable projections $U \in \mathbb{R}^{D\times r}$ and $V \in \mathbb{R}^{r\times D}$, coupled with an intermediate GELU activation, parameterize a context-dependent semantic correction. With $r \ll D$, the correction is confined to a low-dimensional subspace, allowing textual representations to be adaptively refined through a compact transformation. The residual formulation incorporates this correction while retaining a direct pathway for the original embeddings.

The cross-modal fusion is then implemented via a cross-attention module:

$$A(\widetilde{x}, \widetilde{E}) = \mathrm{Concat}\left(\mathrm{head}_1, \ldots, \mathrm{head}_H\right) W^O,$$

where for each head h,

$$\mathrm{head}_h = \mathrm{softmax}\left(\frac{Q_h K_h^\top}{\sqrt{d_k}} + B_h\right) V_h,$$

with

$$Q_h = \widetilde{x} W_h^Q, \quad K_h = \widetilde{E} W_h^K, \quad V_h = \widetilde{E} W_h^V.$$

The cross-modal attention module $A(\cdot,\cdot)$ uses the refined numerical representation $\widetilde{x}$ to guide the selective aggregation of information from the corrected textual embedding $\widetilde{E}$. Head-specific projections W_h^Q, W_h^K, and W_h^V map numerical features to queries and textual features to keys and values, enabling cross-modal matching in distinct representation spaces. By combining scaled query–key similarities with the relative position bias B_h, the attention mechanism accounts for both content relevance and temporal distance, aligning textual context with numerical dynamics. The representations from different heads are concatenated and integrated through the output projection W^O to support downstream forecasting.

We further characterize the robustness of PA-RNet to noisy textual inputs through two theoretical results. Proposition 1 establishes its Lipschitz continuity with respect to textual embeddings, bounding the sensitivity of predictions to embedding perturbations. Proposition 2 further shows how causal semantic correction can reduce the expected prediction error by suppressing prediction variability induced by textual perturbations. Together, these results provide complementary theoretical support for the stability and effectiveness of the proposed representation refinement mechanism. Detailed proofs are provided in Appendix A.

Simulated Textual Noise To evaluate the robustness of PA-RNet to diverse textual corruption, we consider five types of controlled perturbations: irrelevant phrase insertion, token shuffling, antonym substitution, text truncation, and number generalization. These perturbations represent different forms of unreliable context, including irrelevant information, disrupted word order, altered semantics, incomplete descriptions, and reduced numerical specificity. In the main experiment, all five perturbation types are included in a heterogeneous-noise setting to assess overall forecasting performance. We further evaluate each type separately in the Appendix to examine the model's sensitivity to individual sources of textual corruption. Throughout these experiments, the numerical inputs and forecasting targets remain unchanged.

Table 1: Statistics of Datasets from Nine Real-world Domains in Time-MMD Benchmark

Domain	Target	Dimension	Frequency	Samples	Timespan	Lookback	Horizon
Agriculture	Broiler Composite	1	Monthly	496	1983 – Present	8	{6, 8, 10, 12}
Climate	Drought Level	5	Monthly	496	1983 – Present	8	{6, 8, 10, 12}
Economy	International Trade Balance	3	Monthly	423	1989 – Present	8	{6, 8, 10, 12}
Energy	Gasoline Prices	9	Weekly	1479	1996 – Present	36	{12, 24, 36, 48}
Environment	Air Quality Index	4	Daily	11102	1982 – 2023	96	{48, 96, 192, 336}
Health	Influenza Patients Proportion	11	Weekly	1389	1997 – Present	36	{12, 24, 36, 48}
Security	Disaster and Emergency Grants	1	Monthly	297	1999 – Present	8	{6, 8, 10, 12}
Social Good	Unemployment Rate	1	Monthly	900	1950 – Present	8	{6, 8, 10, 12}
Traffic	Travel Volume	1	Monthly	531	1980 – Present	8	{6, 8, 10, 12}

4 Experiments

4.1 Datasets

To evaluate the generalizability and robustness of our model, we conduct experiments on the benchmark Time-MMD dataset suite Liu et al. (2024), which spans 9 real-world domains with diverse temporal resolutions, including monthly, weekly, and daily observations. Notably, the textual modality in Time-MMD is derived from real-world textual sources and is not perfectly aligned with the numerical time series in all cases. It may contain incomplete descriptions, partially irrelevant information, or noisy contextual signals. Therefore, the dataset provides a realistic testbed for assessing whether multimodal forecasting models can effectively exploit textual information under imperfect textual conditions. Further details of the datasets, including dataset statistics, are provided in Table 1.

To avoid information leakage, we follow the preprocessing strategy of TaTS Li et al. (2026), ensuring that textual events used as inputs occur no later than their corresponding time steps.

4.2 BASELINE METHODS

To handle the textual modality, we employ a GPT2-based Radford et al. (2019) encoder to extract textual representations from text inputs under different types and levels of perturbations. After obtaining the textual embeddings, the proposed PA-RNet framework can be flexibly combined with existing time-series forecasting models. To evaluate its compatibility and generality, we integrate PA-RNet with nine widely used backbones from different categories, including: (i) Transformer-based models: iTransformer Liu et al. (2023), PatchTST Nie et al. (2023), Crossformer Zhang and Yan (2023), Autoformer Wu et al. (2021), Informer Zhou et al. (2020), and Transformer Vaswani et al. (2017); (ii) Linear models: DLinear Zeng et al. (2023); and (iii) Frequency-based models: FEDformer Zhou et al. (2022b) and FiLM Zhou et al. (2022a).

For each backbone model, we compare PA-RNet with three representative baselines.

(i) **Numerical-only**: a uni-modal forecasting setting that ignores the paired textual information and only uses numerical time-series inputs.

(ii) **MM-TSFLib** Liu et al. (2024): a recently proposed multimodal time-series forecasting library that incorporates textual information by linearly interpolating the outputs of the time-series model with text embeddings, while treating texts in a bag-of-words manner.

(iii) **TaTS** Li et al. (2026): an architecture for multimodal time-series forecasting that embeds external texts as auxiliary temporal variables to assist prediction.

Beyond these backbone-compatible baselines, we further include representative (iv) **Foundation-model-based methods**: representative methods including **TimeCMA** Liu et al. (2025) and **Time-VLM** Zhong et al. (2025), which leverage pre-trained LLMs or VLMs for multimodal time-series forecasting.

4.3 EXPERIMENTAL SETUP

The experiments were conducted on a Linux system with an x86_64 CPU and 251.38 GB RAM, utilizing NVIDIA RTX 4090 GPUs (24 GB) for computation. The software environment is based on Python 3.11.11 managed via conda, with key packages including `numpy`, `pandas`, `torch`, `transformers`, and others.

4.4 EVALUATION METRICS

To comprehensively evaluate the performance of our model on the multimodal time series forecasting task, we adopt two widely used metrics: Mean Squared Error (MSE) Botchkarev (2018) and Mean Absolute Error (MAE) González-Sopeña et al. (2020). To ensure the reliability of the experimental results, all experiments are repeated with five different random seeds.

4.5 EXPERIMENTAL RESULTS AND INSIGHTS

The experimental results under the original noisy textual conditions are reported in Table 2. Overall, PA-RNet achieves the best or tied-best performance in 129 out of 162 evaluation entries, demonstrating its strong effectiveness on benchmark textual-numerical time-series datasets. In the table, bold font indicates results that are either the best or tied with the strongest competing baseline. We also report the average rank of each method across all datasets, backbones, and metrics, where a lower rank indicates better overall performance Chang et al. (2025); Brigato et al. (2026).

We further evaluate the robustness of PA-RNet under different levels of injected textual perturbations. Specifically, the perturbation ratio ρ is set to 0.3, 0.5, 0.7, and 0.9, and the averaged results across these perturbation levels are presented in Table 3. The results show that PA-RNet consistently maintains superior forecasting performance under increasing textual noise, indicating its robustness against corrupted, irrelevant, or incomplete textual inputs. Additional comparisons with multimodal and foundation-model-based forecasting methods, together with the complete experimental results for the above evaluations, are provided in Appendix B and Appendix F, respectively.

Although PA-RNet achieves overall superior performance, we observe slight degradation on a few dataset-backbone combinations. This may be attributed to three main factors. First, for datasets

Table 2: Forecasting performance on benchmark textual-numerical time-series datasets. Lower MSE/MAE indicates better performance. Bold values indicate the best results or results tied with the best-performing baseline.

Dataset	Method	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Uni-modal	0.103	0.235	0.309	0.405	0.195	0.334	0.100	0.234	0.100	0.198	0.414	0.471	0.096	0.209	0.093	0.197	0.283	0.367
	MM-TSFLib	0.103	0.236	0.248	0.350	**0.144**	**0.259**	0.101	0.232	0.100	0.198	0.342	0.419	0.094	0.205	0.092	0.196	0.230	0.328
	TaTS	0.104	0.237	0.177	0.287	0.152	0.277	0.100	0.236	0.099	0.196	0.214	0.319	0.094	**0.204**	0.092	0.195	0.158	0.282
	PA-RNet	**0.102**	**0.231**	**0.172**	**0.276**	0.150	0.276	**0.100**	**0.228**	**0.099**	**0.196**	**0.207**	**0.313**	**0.094**	0.207	**0.091**	**0.195**	**0.153**	**0.279**
Climate	Uni-modal	1.289	0.919	1.165	0.854	1.283	0.921	1.151	0.864	1.368	0.961	1.168	0.850	1.199	0.900	1.296	0.933	1.062	0.807
	MM-TSFLib	1.133	0.862	1.123	0.835	1.103	0.850	1.037	0.820	1.191	0.894	1.107	0.827	1.106	0.862	1.147	0.873	1.035	0.795
	TaTS	0.993	0.804	1.033	0.789	0.950	0.778	0.964	0.788	0.986	0.797	1.017	0.788	1.018	0.809	1.001	0.800	**0.956**	**0.761**
	PA-RNet	**0.972**	**0.797**	**1.015**	**0.782**	**0.948**	**0.777**	**0.957**	**0.786**	**0.983**	**0.795**	**0.965**	**0.770**	**1.016**	**0.807**	**0.992**	**0.796**	0.970	0.766
Economy	Uni-modal	0.083	0.227	0.566	0.642	0.113	0.281	0.077	0.216	0.018	0.108	0.572	0.712	0.016	0.098	0.019	0.107	0.129	0.276
	MM-TSFLib	0.083	0.223	0.380	0.517	0.050	0.176	0.070	0.207	0.018	0.108	0.490	0.654	0.016	0.098	0.019	0.107	0.167	0.335
	TaTS	0.028	0.132	0.172	0.363	0.016	0.102	0.036	0.145	0.010	0.085	0.310	0.514	0.011	0.085	0.011	0.086	0.133	0.311
	PA-RNet	**0.024**	**0.124**	**0.157**	**0.342**	**0.016**	**0.102**	**0.035**	**0.142**	**0.010**	**0.085**	**0.298**	**0.493**	**0.010**	**0.084**	**0.011**	**0.086**	**0.113**	**0.280**
Energy	Uni-modal	0.357	0.461	0.331	0.429	0.252	**0.354**	0.224	0.342	0.261	0.367	0.387	0.476	0.288	0.403	0.300	0.414	0.369	0.456
	MM-TSFLib	0.351	0.459	**0.320**	**0.419**	0.253	0.358	**0.222**	**0.339**	0.257	0.364	0.383	0.479	0.282	0.400	0.294	0.406	0.361	0.461
	TaTS	**0.344**	**0.452**	0.335	0.428	0.252	0.358	0.239	0.364	0.261	0.368	0.377	0.461	0.296	0.408	0.292	0.408	0.321	0.422
	PA-RNet	0.348	0.454	0.324	0.421	**0.252**	0.355	0.236	0.361	**0.252**	**0.358**	**0.350**	**0.458**	**0.281**	**0.397**	**0.289**	**0.405**	**0.301**	**0.413**
Environment	Uni-modal	0.441	0.528	0.444	0.524	0.532	0.619	0.386	0.484	0.320	0.392	0.438	0.522	0.278	0.389	0.330	0.411	0.384	0.481
	MM-TSFLib	0.371	0.473	0.354	0.447	0.323	0.423	**0.272**	**0.387**	0.274	0.373	0.388	0.481	0.284	0.399	0.301	0.406	0.345	0.447
	TaTS	0.312	0.421	0.298	0.418	0.308	0.441	0.282	0.389	**0.268**	**0.369**	0.291	0.409	0.260	**0.368**	0.269	0.373	0.280	0.394
	PA-RNet	**0.308**	**0.416**	**0.295**	**0.416**	**0.308**	**0.439**	0.284	0.391	0.269	0.370	**0.279**	**0.394**	**0.259**	0.371	**0.269**	**0.373**	**0.277**	**0.391**
Health	Uni-modal	1.810	0.993	1.379	0.781	1.628	0.870	1.487	0.928	1.563	0.851	1.522	0.818	1.825	0.806	1.645	0.788	1.460	0.798
	MM-TSFLib	1.717	0.948	1.320	0.759	1.539	0.840	1.391	0.876	1.463	0.818	1.380	0.776	1.613	0.781	1.442	0.753	1.287	0.755
	TaTS	1.491	0.883	1.231	0.737	1.409	0.800	1.352	0.847	1.350	0.784	1.178	0.731	1.375	0.748	1.260	0.725	1.131	0.705
	PA-RNet	**1.478**	**0.875**	**1.223**	**0.725**	**1.409**	**0.799**	**1.333**	**0.838**	**1.347**	**0.782**	**1.158**	**0.721**	**1.348**	**0.747**	**1.249**	**0.722**	**1.126**	**0.700**
Security	Uni-modal	125.196	5.419	126.382	6.244	109.359	5.196	133.267	5.668	129.269	6.259	130.349	6.578	108.577	4.743	125.985	6.014	126.582	6.271
	MM-TSFLib	125.277	5.510	128.397	6.410	107.439	4.894	131.983	5.642	119.393	5.731	130.325	6.579	107.900	4.837	126.730	6.046	127.868	6.329
	TaTS	110.493	4.937	126.387	6.244	107.388	4.892	108.862	4.917	113.517	**5.166**	**124.675**	**6.185**	**106.983**	**4.803**	125.607	6.006	**122.698**	**5.857**
	PA-RNet	**110.352**	**4.918**	**126.080**	**6.220**	**107.383**	**4.892**	**108.697**	**4.911**	**113.486**	5.167	124.936	6.205	107.446	4.890	**124.245**	**5.972**	123.256	5.922
Social Good	Uni-modal	1.128	**0.593**	0.854	0.471	1.041	0.574	1.180	**0.527**	1.118	0.524	0.805	0.422	1.164	0.593	1.052	0.517	0.819	0.427
	MM-TSFLib	1.087	0.600	0.846	0.477	1.025	0.579	1.128	0.541	1.040	0.537	**0.800**	0.432	**1.047**	**0.535**	1.037	0.544	0.825	0.435
	TaTS	**1.066**	0.598	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.827	0.423	1.129	0.680	**1.036**	0.512	0.832	0.427
	PA-RNet	1.073	0.596	**0.844**	**0.461**	**1.016**	**0.569**	**1.080**	0.569	**1.033**	**0.515**	0.810	**0.417**	1.161	0.593	1.041	**0.507**	**0.810**	**0.426**
Traffic	Uni-modal	0.194	0.273	0.201	0.318	0.325	0.438	0.203	0.274	0.254	0.330	0.163	0.295	0.194	0.242	0.194	0.242	0.163	0.273
	MM-TSFLib	0.181	0.263	0.194	0.312	0.243	0.364	0.187	0.256	0.237	0.317	0.171	0.303	0.194	0.250	0.187	0.244	0.165	0.274
	TaTS	0.162	0.224	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	**0.152**	0.271	0.182	0.222	0.176	0.219	**0.151**	0.256
	PA-RNet	**0.162**	**0.222**	**0.169**	**0.283**	**0.196**	**0.310**	**0.170**	**0.227**	**0.183**	**0.257**	0.156	**0.268**	**0.178**	**0.221**	**0.175**	**0.219**	0.155	**0.244**
Avg. Rank ↓		**PA-RNet**: **1.26** TaTS: 2.01 MM-TSFLib: 2.97 Uni-modal: 3.50																	

such as Energy and Environment, the numerical modality already contains strong periodic or continuous temporal patterns, making the additional textual information less beneficial. In such cases, the perturbation-aware projection module and cross-modal attention modules may introduce extra optimization complexity. Second, for small datasets such as Security, window-based forecasting yields a limited number of training examples, making it more difficult to learn stable cross-modal relationships. The resulting limited supervision may increase the risk of overfitting in the cross-modal attention and low-rank correction modules, reducing the reliability of the learned semantic adjustments. Third, on datasets with more complex event-driven semantics, such as Social Good, simple textual refinement may not fully distinguish useful semantic information from noisy descriptions, resulting in unstable gains under certain backbones. In addition, the inconsistent changes between MSE and MAE on some datasets, such as Traffic, suggest that PA-RNet may reduce average errors while still being affected by a few peak or abrupt-change points. These observations indicate that future work should further explore adaptive fusion strategies and backbone-specific integration mechanisms.

Taken together, the benchmark and perturbation results suggest that perturbation-aware representation refinement can improve multimodal time-series forecasting under noisy textual conditions. By integrating numerical perturbation-aware projection, causal semantic correction, and cross-modal attention, PA-RNet achieves strong overall performance across datasets and backbones. The remaining variation in a few dataset-backbone combinations also points to the need for more adaptive cross-modal fusion.

4.6 Further Analysis

Ablation on Key Modules To assess the effectiveness of the proposed components, we conduct ablation studies on three key modules of PA-RNet: the cross-attention mechanism, the frequency-

Table 3: Average robustness results under textual perturbations on benchmark textual-numerical time-series datasets. For MM-TSFLib, TaTS, and PA-RNet, results are averaged over perturbation ratios $\rho \in \{0.3, 0.5, 0.7, 0.9\}$. Bold values indicate the best results or results tied with the best-performing baseline.

Dataset	Method	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Uni-modal	0.103	0.235	0.309	0.405	0.195	0.334	0.100	0.234	0.100	0.198	0.414	0.471	0.096	0.209	0.093	0.197	0.283	0.367
	MM-TSFLib	0.103	0.236	0.247	0.349	**0.144**	**0.260**	0.101	0.232	0.100	0.198	0.345	0.422	0.103	0.232	0.092	0.196	0.232	0.331
	TaTS	0.104	0.235	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.214	0.319	0.094	**0.205**	0.092	0.195	0.158	0.282
	PA-RNet	**0.103**	**0.234**	**0.172**	**0.276**	0.150	0.276	**0.100**	**0.228**	**0.099**	**0.196**	**0.210**	**0.316**	**0.094**	0.207	**0.091**	**0.195**	**0.157**	**0.280**
Climate	Uni-modal	1.289	0.919	1.165	0.854	1.283	0.921	1.151	0.864	1.368	0.961	1.168	0.850	1.199	0.900	1.296	0.933	1.062	0.807
	MM-TSFLib	1.135	0.861	1.124	0.835	1.102	0.850	1.041	0.820	1.192	0.895	1.113	0.829	1.105	0.861	1.151	0.874	1.036	0.796
	TaTS	1.001	0.808	1.033	0.789	0.950	0.778	0.961	0.788	0.986	0.797	1.012	0.786	1.020	0.809	1.001	0.800	**0.956**	**0.761**
	PA-RNet	**0.974**	**0.798**	**1.015**	**0.782**	**0.948**	**0.777**	**0.957**	**0.786**	**0.983**	**0.795**	**0.969**	**0.773**	**1.014**	**0.806**	**0.992**	**0.796**	0.968	0.766
Economy	Uni-modal	0.083	0.227	0.566	0.642	0.113	0.281	0.077	0.216	0.018	0.108	0.572	0.712	0.016	0.098	0.019	0.107	0.129	0.276
	MM-TSFLib	0.085	0.225	0.405	0.546	0.051	0.177	0.070	0.207	0.018	0.108	0.482	0.648	0.016	0.098	0.019	0.107	0.166	0.334
	TaTS	0.026	0.128	0.162	0.347	0.016	0.102	0.036	0.145	0.010	0.085	0.307	0.511	0.011	0.085	0.011	0.086	**0.133**	0.311
	PA-RNet	**0.024**	**0.122**	**0.152**	**0.338**	**0.016**	**0.102**	**0.035**	**0.142**	**0.010**	**0.085**	**0.300**	**0.497**	**0.010**	**0.084**	**0.011**	**0.086**	0.134	**0.308**
Health	Uni-modal	1.810	0.993	1.379	0.781	1.628	0.870	1.487	0.928	1.563	0.851	1.522	0.818	1.825	0.806	1.645	0.788	1.460	0.798
	MM-TSFLib	1.723	0.954	1.327	0.760	1.538	0.840	1.398	0.881	1.463	0.819	1.388	0.777	1.615	0.782	1.444	0.754	1.308	0.757
	TaTS	1.496	0.883	1.208	**0.726**	1.409	0.800	1.347	0.846	1.350	0.784	1.170	0.727	1.380	0.749	1.260	0.725	**1.135**	0.706
	PA-RNet	**1.488**	**0.877**	**1.206**	0.727	**1.409**	**0.799**	**1.333**	**0.839**	**1.347**	**0.782**	**1.157**	**0.720**	**1.371**	**0.753**	**1.249**	**0.722**	1.140	**0.705**
Social Good	Uni-modal	1.128	**0.593**	0.854	0.471	1.041	0.574	1.180	**0.527**	1.118	0.524	0.805	0.422	1.164	0.593	1.052	0.517	0.819	**0.427**
	MM-TSFLib	1.084	0.601	0.846	0.478	1.022	0.578	1.129	0.541	1.038	0.536	**0.800**	0.427	**1.045**	**0.531**	**1.015**	0.532	0.833	0.437
	TaTS	**1.075**	0.604	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.826	0.422	1.123	0.671	1.044	0.519	0.831	0.427
	PA-RNet	1.083	0.603	**0.842**	**0.461**	**1.016**	**0.569**	**1.067**	0.559	**1.033**	**0.515**	0.804	**0.419**	1.172	0.602	1.041	**0.507**	**0.819**	0.428
Traffic	Uni-modal	0.194	0.273	0.201	0.318	0.325	0.438	0.203	0.274	0.254	0.330	0.163	0.295	0.194	0.242	0.193	0.242	0.163	0.273
	MM-TSFLib	0.185	0.267	0.194	0.312	0.245	0.367	0.188	0.259	0.237	0.316	0.170	0.302	0.187	0.242	0.187	0.245	0.165	0.273
	TaTS	0.164	0.225	0.170	0.285	0.197	0.311	0.171	**0.228**	0.183	0.258	**0.152**	0.270	0.183	0.223	0.176	0.219	**0.151**	0.256
	PA-RNet	**0.163**	**0.225**	**0.169**	**0.283**	**0.196**	**0.310**	**0.171**	0.229	**0.183**	**0.257**	0.153	**0.261**	**0.178**	**0.221**	**0.175**	**0.219**	0.154	**0.247**
Avg. Rank ↓		**PA-RNet**: **1.26** TaTS: 1.98 MM-TSFLib: 2.96 Uni-modal: 3.48																	

Table 4: Ablation study of PA-RNet on Economy, Health, and Agriculture datasets. The best results are highlighted in **bold**, and the second-best results are underlined.

Dataset	Horizon	w/o cross-attention		w/o semantic correction		w/o perturbation-aware		PA-RNet	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Economy	6	0.116	0.296	0.108	0.283	0.090	0.254	**0.069**	**0.221**
	8	0.166	0.365	0.137	**0.317**	0.148	0.334	**0.132**	0.318
	10	0.213	0.415	0.247	0.447	0.235	0.442	**0.211**	**0.413**
	12	0.271	0.469	0.260	0.466	0.230	0.433	**0.216**	**0.417**
	Avg	0.192	0.386	0.188	0.378	0.176	0.366	**0.157**	**0.342**
Health	12	1.155	0.734	1.103	0.725	1.053	0.692	**0.999**	**0.672**
	24	1.270	0.741	1.275	0.753	1.346	0.779	**1.270**	**0.737**
	36	1.272	**0.736**	**1.263**	0.739	1.291	0.749	1.268	0.737
	48	1.389	0.774	1.363	0.767	1.368	0.768	**1.353**	**0.754**
	Avg	1.272	0.746	1.251	0.746	1.265	0.747	**1.223**	**0.725**
Agriculture	6	0.099	0.227	0.098	0.220	0.100	0.231	**0.093**	**0.220**
	8	**0.144**	**0.254**	0.155	0.270	0.148	0.258	0.146	0.261
	10	0.197	0.297	0.201	0.311	**0.184**	**0.286**	0.197	0.293
	12	0.264	0.346	0.254	0.351	0.266	0.350	**0.252**	**0.329**
	Avg	0.176	0.281	0.177	0.288	0.175	0.281	**0.172**	**0.276**

domain enhancement module, and the perturbation-aware projection module. We compare the full model with three variants: *w/o cross-attention*, where cross-attention is replaced by simple concatenation; *w/o causal semantic correction*, where frequency-domain modeling is removed; and *w/o perturbation-aware projection module*, where the perturbation-aware projection module is discarded and the original textual embeddings are directly used.

All variants are trained under the same settings as the full model for a fair comparison. The results in Table 4 show that removing any component leads to a noticeable drop in performance in most cases, indicating that these modules are complementary and jointly contribute to accurate and robust multimodal time series forecasting.

Hyperparameter Settings and Sensitivity Analysis To support reproducibility, Appendix C summarizes the main training settings, including sequence length, learning rate, rank, prior weight, and module-specific learning rates. We also examine whether PA-RNet's performance is sensitive to two architectural choices: the projection dimension, which determines the capacity of the perturbation-aware projection module, and the number of cross-attention heads, which controls how cross-modal interactions are modeled. Using Crossformer as the backbone, we evaluate both parameters on the Agriculture, Economy, and Traffic datasets in terms of MAE. As reported in Appendix E, a projection dimension of 96 and 8 cross-attention heads yield the best overall performance and are therefore used as the default settings.

Visualization of Prediction Distributions MSE and MAE summarize forecasting accuracy but do not show how predictions are distributed relative to the ground truth after textual corruption. To provide a qualitative view, we conduct a t-SNE case study on the Health dataset, using Autoformer as the backbone with a prediction length of 48. As shown in Appendix D, PA-RNet's projected predictions remain more closely aligned with the ground-truth distribution after textual noise injection, whereas MM-TSFLib and TaTS show larger deviations. This observation is consistent with the robustness indicated by the quantitative results.

Robustness under Different Text Perturbation Strategies Results averaged across perturbations may conceal sensitivity to particular ways of altering the text. We therefore evaluate PA-RNet under five distinct strategies: Generalize, Reverse, Shuffle, Insert, and Truncate. By changing the textual input in different ways, these strategies test whether the model's performance depends on a specific noise pattern. Appendix G reports the MSE and MAE results for each strategy, providing a more detailed assessment of robustness across textual perturbations.

Comparison with Clean-Enhanced Baselines Text cleaning offers a preprocessing-based approach to handling corrupted descriptions, whereas PA-RNet addresses unreliable information within the forecasting model. To assess whether adding a cleaning step can achieve comparable robustness, we evaluate clean-enhanced versions of MM-TSFLib and TaTS alongside PA-RNet. Appendix H reports their average MSE and MAE over four textual perturbation ratios, $\rho \in \{0.3, 0.5, 0.7, 0.9\}$. This comparison helps determine whether PA-RNet's gains extend beyond those attainable through text cleaning of existing frameworks.

Robustness under Sparse Input Conditions In practice, forecasting inputs may be incomplete, leaving less information for temporal modeling and cross-modal fusion. To assess PA-RNet under reduced input availability, we evaluate it at masking ratios $m \in \{0.3, 0.5, 0.7, 0.9\}$. Appendix I presents both a summary of performance across masking ratios and the complete MSE and MAE results at each ratio. These results allow us to examine how forecasting accuracy changes as the input becomes increasingly sparse, complementing the evaluations under noisy text.

5 Conclusion and Future Work

Unreliable textual context can compromise multimodal time-series forecasting when its influence is carried directly into cross-modal fusion. To address this issue, we proposed PA-RNet, which refines numerical and textual representations before aligning textual semantics with temporal dynamics. Our theoretical analysis establishes Lipschitz continuity with respect to textual embeddings and explains how semantic correction can reduce expected prediction error by suppressing prediction variability induced by textual perturbations. Experiments on nine multimodal time-series datasets show that PA-RNet performs consistently with original textual inputs and remains robust under simulated textual noise. Together, these findings suggest that refining representations before fusion is an effective way to make use of textual context while limiting the impact of unreliable information. Future work will examine more systematic forms of textual noise beyond the perturbations considered here. We will also investigate whether this refinement principle extends to other temporal prediction tasks and can be incorporated into large-scale pretrained multimodal models.

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A Theoretical Proofs of Robustness Analysis

We adopt the notation of the main text. Let $x \in \mathbb{R}^{B\times L\times 1}$ denote the observed time-series values and $E \in \mathbb{R}^{B\times L\times D}$ the textual embeddings, where B is the batch size, L the lookback length, and D the embedding dimension. We omit the batch dimension and conduct the analysis for a single sample. All model parameters are held fixed, and the analysis considers deterministic predictions.

For a fixed numerical input x, the refined numerical representation is

$$\widetilde{x} = \mathrm{LN}\left(x - \sigma(\Gamma_x(x)) \cdot \Phi_x(x)\right).$$

Since x is fixed, $\widetilde{x}$ is independent of variations in the textual input considered in the following analysis.

The causal semantic correction (CSC) module refines the textual embedding through

$$\widetilde{E} = E + \Psi_e(E),$$

where

$$\Psi_e(E) = \mathrm{GELU}\left(\left(\mathrm{softmax}\left(\frac{EE^\top}{\sqrt{D}} + M\right)E\right)U\right)V.$$

Here, M is a fixed causal mask, and U and V are the learned projection matrices of the low-rank correction module. The masked softmax is evaluated rowwise over the allowed positions, with each row retaining at least its current position.

To distinguish textual correction from the subsequent prediction process, define

$$g(x, Z) \coloneqq F\left(x \parallel A(\widetilde{x}, Z)\right),$$

where Z denotes the textual representation supplied to the cross-attention module. The complete PA-RNet model is therefore

$$f(x, E) = g(x, \widetilde{E}) = g(x, E + \Psi_e(E)).$$

Accordingly, $g(x, E)$ and $g(x, \widetilde{E})$ represent predictions before and after textual correction, respectively, with the same downstream model parameters.

Proposition 1 (Lipschitz Continuity)**.** *For a fixed numerical input x, consider the textual embedding domain*

$$\mathcal{D}_R \coloneqq \left\{E \in \mathbb{R}^{L\times D} : \|E\|_F \le R\right\},$$

where $R > 0$. Let $\mathcal{Z}_R$ be a bounded domain containing both $\mathcal{D}_R$ and its corrected image:

$$\mathcal{D}_R \cup \{E + \Psi_e(E) : E \in \mathcal{D}_R\} \subseteq \mathcal{Z}_R.$$

Assume that $A(\widetilde{x}, \cdot)$ is Lipschitz continuous on $\mathcal{Z}_R$ with constant $L_A > 0$, and that F is Lipschitz continuous on the corresponding fused-input domain with constant $L_F > 0$.

Then the CSC residual mapping Ψ_e is Lipschitz continuous on $\mathcal{D}_R$ with a finite constant L_Ψ. Moreover, the downstream prediction map satisfies

$$\|g(x, Z) - g(x, Z')\|_2 \le L_g\|Z - Z'\|_F, \qquad Z, Z' \in \mathcal{Z}_R,$$

where

$$L_g = L_F L_A.$$

Consequently, the complete model is Lipschitz continuous with respect to its textual input:

$$\|f(x, E) - f(x, E')\|_2 \le L_f\|E - E'\|_F, \qquad E, E' \in \mathcal{D}_R,$$

with

$$L_f = L_g(1 + L_\Psi) = L_F L_A(1 + L_\Psi).$$

Proof. We first establish the Lipschitz continuity of the textual correction map and then combine it with the continuity of cross-modal fusion and forecasting.

Step 1: Lipschitz continuity of textual correction.

Define the causal semantic aggregation map

$$H(E) \coloneqq \mathrm{softmax}\left(\frac{EE^\top}{\sqrt{D}} + M\right) E.$$

For any $E, E' \in \mathcal{D}_R$, the attention scores satisfy

$$\begin{aligned}\|EE^\top - E'E'^\top\|_F &= \|(E-E')E^\top + E'(E-E')^\top\|_F \\ &\le (\|E\|_2 + \|E'\|_2)\,\|E-E'\|_F \\ &\le 2R\|E-E'\|_F.\end{aligned}$$

Thus, the score map is Lipschitz continuous on $\mathcal{D}_R$.

For the fixed causal mask, each softmax row is evaluated only over its allowed positions. The resulting map is smooth in the finite, unmasked scores and has a bounded Jacobian on the considered score domain. The masked positions remain identically zero and therefore do not affect this continuity property.

Since both the attention weights and the embeddings are bounded, their product is also Lipschitz continuous on $\mathcal{D}_R$. Hence, there exists a finite constant $C_{\mathrm{agg}}(R)$ such that

$$\|H(E) - H(E')\|_F \le C_{\mathrm{agg}}(R)\|E-E'\|_F.$$

Let C_{gel} be a finite Lipschitz constant of the elementwise GELU activation. Using the spectral norms of the projection matrices U and V, we obtain

$$\begin{aligned}\|\Psi_e(E) - \Psi_e(E')\|_F &= \|\mathrm{GELU}(H(E)U)V - \mathrm{GELU}(H(E')U)V\|_F \\ &\le C_{\mathrm{gel}}\|U\|_2\|V\|_2\|H(E) - H(E')\|_F \\ &\le L_\Psi\|E-E'\|_F,\end{aligned}$$

where

$$L_\Psi = C_{\mathrm{agg}}(R)C_{\mathrm{gel}}\|U\|_2\|V\|_2.$$

Therefore, the corrected textual representations satisfy

$$\begin{aligned}\|\widetilde{E} - \widetilde{E}'\|_F &= \|(E + \Psi_e(E)) - (E' + \Psi_e(E'))\|_F \\ &\le \|E-E'\|_F + \|\Psi_e(E) - \Psi_e(E')\|_F \\ &\le (1 + L_\Psi)\|E-E'\|_F.\end{aligned}$$

Step 2: Lipschitz continuity of cross-modal fusion.

For a textual representation $Z \in \mathcal{Z}_R$, the multi-head cross-attention module is

$$A(\widetilde{x}, Z) = \mathrm{Concat}\left(\mathrm{head}_1(Z), \ldots, \mathrm{head}_H(Z)\right) W^O,$$

where

$$\mathrm{head}_h(Z) = \mathrm{softmax}\left(\frac{Q_h K_h(Z)^\top}{\sqrt{d_k}} + B_h\right) V_h(Z),$$

with

$$Q_h = \widetilde{x}W_h^Q, \qquad K_h(Z) = ZW_h^K, \qquad V_h(Z) = ZW_h^V.$$

For fixed x, the query Q_h is fixed, while the key and value mappings are linear in Z. The relative position bias B_h is also fixed for the considered sequence length. On the bounded domain $\mathcal{Z}_R$, the attention scores and values remain bounded. Together with the smoothness of softmax and the linearity of the head concatenation and output projection, these properties yield Lipschitz continuity with respect to Z.

Using the constant L_A specified in the proposition, we have

$$\|A(\widetilde{x}, Z) - A(\widetilde{x}, Z')\|_F \le L_A \|Z - Z'\|_F, \qquad Z, Z' \in \mathcal{Z}_R.$$

Step 3: Lipschitz continuity of the prediction maps.

By the assumed Lipschitz continuity of the forecasting backbone, for any two fusion outputs z and z' in the considered domain,

$$\|F(x \parallel z) - F(x \parallel z')\|_2 \le L_F \|z - z'\|_F.$$

Here, concatenation with the fixed numerical input preserves the input difference:

$$\|(x \parallel z) - (x \parallel z')\|_F = \|z - z'\|_F.$$

Combining this bound with Step 2 gives, for any $Z, Z' \in \mathcal{Z}_R$,

$$\begin{aligned} \|g(x, Z) - g(x, Z')\|_2 &= \|F\left(x \parallel A(\widetilde{x}, Z)\right) - F\left(x \parallel A(\widetilde{x}, Z')\right)\|_2 \\ &\le L_F \|A(\widetilde{x}, Z) - A(\widetilde{x}, Z')\|_F \\ &\le L_F L_A \|Z - Z'\|_F. \end{aligned}$$

Thus, the downstream prediction map has Lipschitz constant

$$L_g = L_F L_A.$$

Finally, for $E, E' \in \mathcal{D}_R$, both corrected representations belong to $\mathcal{Z}_R$. Using $f(x, E) = g(x, \widetilde{E})$ and the bound from Step 1, we obtain

$$\begin{aligned} \|f(x, E) - f(x, E')\|_2 &= \|g(x, \widetilde{E}) - g(x, \widetilde{E}')\|_2 \\ &\le L_g \|\widetilde{E} - \widetilde{E}'\|_F \\ &\le L_g (1 + L_\Psi) \|E - E'\|_F. \end{aligned}$$

Therefore, the complete PA-RNet model is Lipschitz continuous with respect to textual embeddings on $\mathcal{D}_R$, with

$$L_f = L_F L_A (1 + L_\Psi), \qquad L_\Psi = C_{\text{agg}}(R) C_{\text{gel}} \|U\|_2 \|V\|_2.$$

□

Proposition 2 (Expected Error Reduction via Causal Semantic Correction)**.** *Fix a numerical input x, a clean textual embedding E^{signal}, and a prediction target y. Let $f(x, Z)$ denote the prediction map of PA-RNet evaluated at textual representation Z. Throughout this proposition and its proof, all model parameters are held fixed, and expectations are taken over textual perturbations conditional on x, E^{signal}, and y. For notational simplicity, this conditioning is omitted.*

The corrected textual embedding is defined as

$$\widetilde{E} = E + \Psi_e(E),$$

where

$$\Psi_e(E) = \text{GELU}\left(\left(\text{softmax}\left(\frac{EE^\top}{\sqrt{D}} + M\right) E\right) U\right) V.$$

Assume that the perturbed textual embedding admits the decomposition

$$E = E^{\text{signal}} + E^{\text{noise}},$$

where E^{noise} has zero mean and finite second moment:

$$\mathbb{E}\left[E^{\text{noise}}\right] = 0, \qquad \mathbb{E}\left[\|E^{\text{noise}}\|_F^2\right] < \infty.$$

Define the residual perturbation after correction as

$$\varepsilon := E^{\text{noise}} + \Psi_e(E),$$

so that

$$\Psi_e(E) = -E^{\text{noise}} + \varepsilon, \qquad \widetilde{E} = E^{\text{signal}} + \varepsilon.$$

Suppose that, for constants $0 < \mu \le L_f$, the prediction map satisfies

$$\mu\|u - v\|_F \le \|f(x,u) - f(x,v)\|_2 \le L_f\|u - v\|_F$$

for all u, v in the considered embedding domain, which contains E^{signal}, E, and $\widetilde{E}$ almost surely. Assume further that the original and residual perturbations are output-unbiased:

$$\mathbb{E}[f(x,E)] = \mathbb{E}\Big[f(x,\widetilde{E})\Big] = f(x,E^{\text{signal}}).$$

If the residual perturbation satisfies

$$\mathbb{E}[\varepsilon] = 0, \qquad \mathbb{E}\big[\|\varepsilon\|_F^2\big] < \left(\frac{\mu}{L_f}\right)^2 \mathbb{E}\big[\|E^{\text{noise}}\|_F^2\big]\,,$$

then causal semantic correction strictly reduces the expected squared prediction error:

$$\mathbb{E}\Big[\mathcal{L}(f(x,\widetilde{E}),y)\Big] < \mathbb{E}[\mathcal{L}(f(x,E),y)]\,,$$

where

$$\mathcal{L}(f(x,Z),y) = \|f(x,Z) - y\|_2^2.$$

Proof. By the decomposition of the textual embedding and the definition of the residual perturbation, we have

$$E = E^{\text{signal}} + E^{\text{noise}}, \qquad \Psi_e(E) = -E^{\text{noise}} + \varepsilon.$$

Therefore, the corrected textual embedding satisfies

$$\begin{aligned}\widetilde{E} &= E + \Psi_e(E)\\ &= E^{\text{signal}} + E^{\text{noise}} - E^{\text{noise}} + \varepsilon\\ &= E^{\text{signal}} + \varepsilon.\end{aligned}$$

Thus, the perturbation relative to the clean textual embedding is E^{noise} before correction and ε after correction.

Let

$$m \coloneqq f(x,E^{\text{signal}})$$

denote the model output under the clean textual embedding. Define the predictions before and after correction as

$$Z_{\text{noise}} \coloneqq f(x,E) = f(x,E^{\text{signal}} + E^{\text{noise}}),$$

and

$$Z_{\text{corr}} \coloneqq f(x,\widetilde{E}) = f(x,E^{\text{signal}} + \varepsilon).$$

By the output-unbiasedness assumption,

$$\mathbb{E}[Z_{\text{noise}}] = \mathbb{E}[Z_{\text{corr}}] = m.$$

Recall that all expectations are conditional on the fixed x, E^{signal}, and y. Consequently, both m and y are fixed under these expectations. For either $Z \in \{Z_{\text{noise}}, Z_{\text{corr}}\}$, the cross term therefore vanishes:

$$\mathbb{E}\left[\langle Z - m, m - y\rangle\right] = \langle \mathbb{E}[Z - m], m - y\rangle = 0.$$

Expanding the squared prediction errors gives

$$\mathbb{E}\left[\|Z_{\text{noise}} - y\|_2^2\right] = \|m - y\|_2^2 + \mathbb{E}\left[\|Z_{\text{noise}} - m\|_2^2\right],$$

and

$$\mathbb{E}\left[\|Z_{\text{corr}} - y\|_2^2\right] = \|m - y\|_2^2 + \mathbb{E}\left[\|Z_{\text{corr}} - m\|_2^2\right].$$

The clean prediction error $\|m - y\|_2^2$ is shared by both expressions. Hence, comparing the expected prediction errors reduces to comparing the perturbation-induced output variances.

By the Lipschitz upper bound,

$$\begin{aligned}\|Z_{\text{corr}} - m\|_2 &= \big\|f(x,E^{\text{signal}} + \varepsilon) - f(x,E^{\text{signal}})\big\|_2\\ &\le L_f\|\varepsilon\|_F.\end{aligned}$$

Squaring both sides and taking expectations yields

$$\mathbb{E}\left[\|Z_{\text{corr}} - m\|_2^2\right] \leq L_f^2 \mathbb{E}\left[\|\varepsilon\|_F^2\right].$$

Similarly, the assumed reverse bound gives

$$\begin{aligned}\|Z_{\text{noise}} - m\|_2 &= \left\|f(x, E^{\text{signal}} + E^{\text{noise}}) - f(x, E^{\text{signal}})\right\|_2 \\ &\geq \mu \|E^{\text{noise}}\|_F.\end{aligned}$$

Therefore,

$$\mathbb{E}\left[\|Z_{\text{noise}} - m\|_2^2\right] \geq \mu^2 \mathbb{E}\left[\|E^{\text{noise}}\|_F^2\right].$$

By the assumed bound on the second moment of the residual perturbation, we have

$$L_f^2 \mathbb{E}\left[\|\varepsilon\|_F^2\right] < \mu^2 \mathbb{E}\left[\|E^{\text{noise}}\|_F^2\right].$$

Combining these inequalities, we obtain

$$\begin{aligned}\mathbb{E}\left[\|Z_{\text{corr}} - m\|_2^2\right] &\leq L_f^2 \mathbb{E}\left[\|\varepsilon\|_F^2\right] \\ &< \mu^2 \mathbb{E}\left[\|E^{\text{noise}}\|_F^2\right] \\ &\leq \mathbb{E}\left[\|Z_{\text{noise}} - m\|_2^2\right].\end{aligned}$$

Thus, the corrected prediction has strictly smaller perturbation-induced variance.

Consequently,

$$\begin{aligned}\mathbb{E}\left[\mathcal{L}(f(x, \widetilde{E}), y)\right] &= \|m - y\|_2^2 + \mathbb{E}\left[\|Z_{\text{corr}} - m\|_2^2\right] \\ &< \|m - y\|_2^2 + \mathbb{E}\left[\|Z_{\text{noise}} - m\|_2^2\right] \\ &= \mathbb{E}\left[\mathcal{L}(f(x, E), y)\right].\end{aligned}$$

Therefore, under the stated conditions, causal semantic correction strictly reduces the expected prediction error. □

B Additional Comparison with Multimodal and Foundation-Model-Based Forecasting Methods

Table 5: Comparison with multimodal and foundation-model-based forecasting methods. The best results are highlighted in bold.

Dataset	TimeVLM		TimeCMA		PA-RNet (iTransformer)	
	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	0.302	0.360	0.116	0.219	**0.094**	**0.207**
Climate	1.186	0.886	1.518	1.001	**1.016**	**0.807**
Economy	0.061	0.196	0.045	0.173	**0.010**	**0.084**
Energy	0.344	0.457	0.414	0.497	**0.281**	**0.397**
Environment	0.546	0.608	0.353	0.420	**0.259**	**0.371**
Health	1.907	1.019	2.694	1.205	**1.348**	**0.747**
Security	124.522	5.647	130.984	6.192	**107.446**	**4.890**
Social Good	**1.033**	**0.544**	1.180	0.581	1.161	0.593
Traffic	0.205	0.309	0.350	0.456	**0.178**	**0.221**

C Hyperparameter Settings

Table 6: Hyperparameter Settings for Model Training

Hyperparameter	**Description**	**Value or Choices**
Batch size	Training batch size	32
Seq_len	Input sequence length	{8, 36, 96}
Label_len	Label sequence length	{4, 18, 48}
Criterion	Loss function	Mean Square Error (MSE)
Model learning rate	Learning rate for the time series backbone model	{0.01, 0.001, 0.0001, 0.00001}
Rank	Rank of the linear layer before FFT	{4, 8, 16, 32, 64}
Module learning rate	semantic correction, cross-attention, perturbation modules	$\{10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}\}$
Cross-attention heads	Number of attention heads in cross-attention	8
Prior weight	Weight for prior combination	{0,0.1,0.2,0.3,0.5}
Training epochs	Total number of training epochs	50
Patience	Early stopping patience	20
Text embedding dimension	Dimension of textual embeddings	12
Pooling type	Embedding pooling method	avg
Initialization method	Weight initialization method	normal
Dropout rate	Dropout probability	0.1
Use normalization	Whether to use normalization	TRUE

D VISUALIZATION CASE STUDY

We provide a t-SNE visualization on the Health dataset to qualitatively assess the robustness of different multimodal forecasting frameworks. Autoformer is adopted as the backbone, and the prediction length is set to 48. As shown in Figure 2, PA-RNet preserves a more stable prediction distribution after textual noise injection, with its projected points remaining better aligned with the ground-truth distribution. In contrast, MM-TSFLib and TaTS show larger distributional deviations under noisy textual conditions. This visualization further confirms that PA-RNet is more effective in resisting textual perturbations and maintaining reliable forecasting representations.

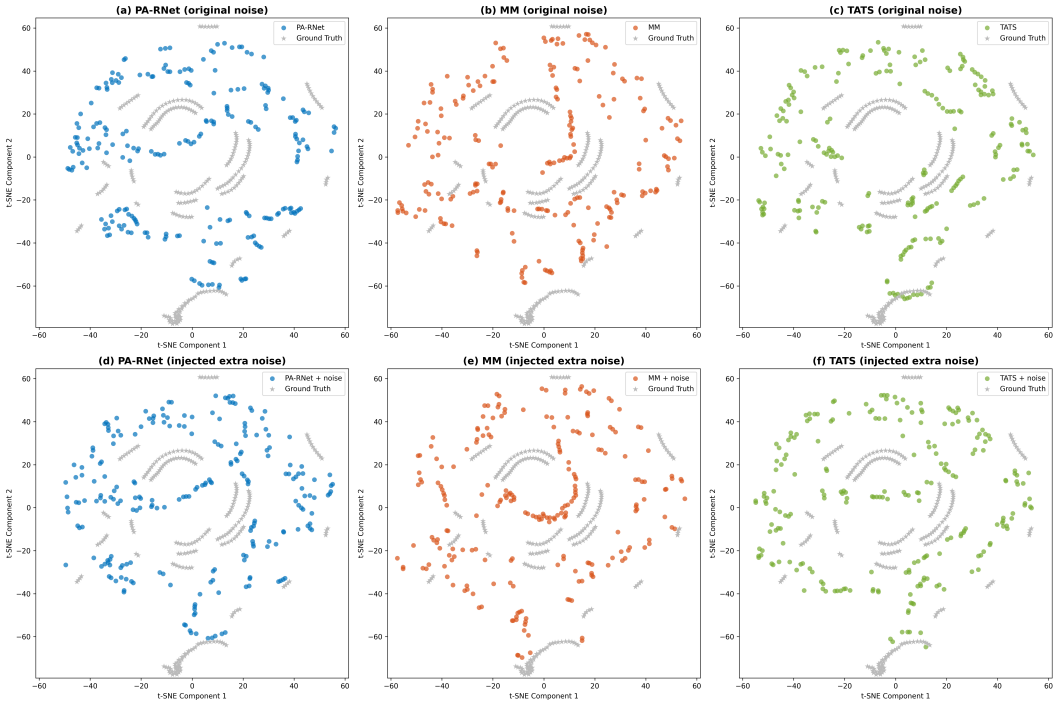

Figure 2: t-SNE visualization on the Health dataset before and after injecting extra textual noise.

E PARAMETER SENSITIVITY ANALYSIS

To examine the influence of key hyperparameters, we conduct a sensitivity analysis on PA-RNet with Crossformer as the backbone forecasting model. Specifically, we study the projection dimension of the perturbation-aware projection module. The results are reported on the Agriculture, Economy, and Traffic datasets using MAE.

As shown in Figure 3(a), the projection dimension is varied among 72, 84, 96, and 108. The model obtains the best overall performance when the projection dimension is set to 96, indicating that this setting provides a suitable representation capacity for perturbation-related numerical components. Therefore, we use 96 as the default projection dimension. Figure 3(b) reports the sensitivity of PA-RNet to the number of cross-attention heads. The best overall performance is obtained with 8 heads, with results declining on both sides, suggesting that this setting strikes a good trade-off between the number of cross-modal alignment subspaces and the capacity of each head. We therefore set the number of cross-attention heads to 8.

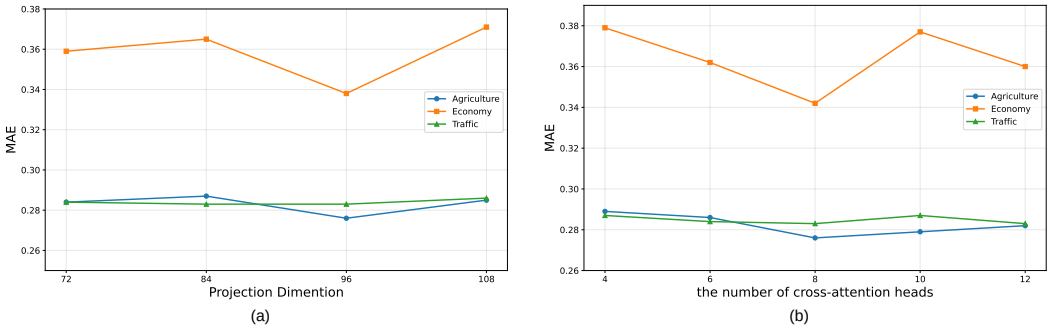

Figure 3: Parameter sensitivity analysis of PA-RNet with Crossformer as the backbone forecasting model. (a) Projection dimension in the perturbation-aware numerical projection module. (b)The number of cross-attention heads in the cross attention module.

F COMPLETE RESULTS UNDER ORIGINAL AND PERTURBED TEXTUAL CONDITIONS

Table 7: Detailed forecasting results on Agriculture, Climate, and Economy under the original noisy textual conditions. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Uni-modal	6	0.078	0.205	0.173	0.303	0.156	0.302	0.074	0.195	0.066	0.160	0.272	0.384	0.067	0.180	0.059	0.160	0.199	0.315
		8	0.091	0.217	0.266	0.373	0.173	0.320	0.090	0.219	0.084	0.183	0.315	0.403	0.079	0.188	0.079	0.183	0.208	0.311
		10	0.110	0.248	0.362	0.450	0.206	0.343	0.105	0.247	0.108	0.209	0.490	0.530	0.102	0.219	0.101	0.206	0.305	0.390
		12	0.134	0.269	0.436	0.495	0.247	0.371	0.132	0.273	0.142	0.241	0.578	0.567	0.134	0.247	0.131	0.238	0.419	0.451
		Avg	0.103	0.235	0.309	0.405	0.195	0.334	0.100	0.234	0.100	0.198	0.414	0.471	0.096	0.209	0.093	0.197	0.283	0.367
	MM-TSFLib	6	0.076	0.198	0.138	0.258	0.098	0.214	0.073	0.194	0.067	0.161	0.203	0.319	0.063	0.173	0.061	0.163	0.164	0.281
		8	0.093	0.223	0.246	0.359	0.132	0.257	0.091	0.219	0.085	0.184	0.262	0.366	0.078	0.186	0.078	0.182	0.216	0.323
		10	0.108	0.249	0.272	0.373	0.154	0.273	0.108	0.247	0.110	0.211	0.384	0.451	0.103	0.220	0.098	0.204	0.251	0.345
		12	0.133	0.273	0.335	0.409	0.191	0.292	0.134	0.268	0.139	0.236	0.518	0.539	0.131	0.241	0.131	0.235	0.290	0.363
		Avg	0.103	0.236	0.248	0.350	0.144	0.259	0.101	0.232	0.100	0.198	0.342	0.419	0.094	0.205	0.092	0.196	0.230	0.328
	TaTS	6	0.075	0.192	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.121	0.257	0.063	0.173	0.060	0.161	0.096	0.249
		8	0.094	0.231	0.155	0.275	0.133	0.264	0.087	0.220	0.083	0.181	0.163	0.289	0.079	0.190	0.078	0.181	0.125	0.267
		10	0.111	0.253	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.229	0.325	0.101	0.212	0.100	0.204	0.177	0.290
		12	0.136	0.272	0.255	0.339	0.194	0.308	0.131	0.271	0.139	0.236	0.342	0.404	0.131	0.240	0.130	0.235	0.233	0.322
		Avg	0.104	0.237	0.177	0.287	0.152	0.277	0.100	0.236	0.099	0.196	0.214	0.319	0.094	0.204	0.092	0.195	0.158	0.282
	PA-RNet	6	0.075	0.193	0.093	0.220	0.118	0.249	0.074	0.191	0.065	0.159	0.117	0.253	0.065	0.178	0.060	0.161	0.098	0.246
		8	0.089	0.216	0.146	0.261	0.135	0.264	0.088	0.215	0.084	0.182	0.168	0.294	0.081	0.194	0.077	0.181	0.122	0.263
		10	0.106	0.245	0.197	0.293	0.158	0.283	0.107	0.239	0.108	0.208	0.227	0.323	0.101	0.212	0.099	0.203	0.167	0.289
		12	0.137	0.271	0.252	0.329	0.190	0.307	0.131	0.267	0.139	0.235	0.315	0.382	0.130	0.243	0.129	0.236	0.224	0.318
		Avg	0.102	0.231	0.172	0.276	0.150	0.276	0.100	0.228	0.099	0.196	0.207	0.313	0.094	0.207	0.091	0.195	0.153	0.279
Climate	Uni-modal	6	1.315	0.930	1.151	0.844	1.309	0.929	1.093	0.834	1.337	0.940	1.118	0.821	1.160	0.892	1.285	0.925	1.058	0.798
		8	1.296	0.924	1.153	0.846	1.270	0.918	1.136	0.849	1.380	0.967	1.158	0.845	1.206	0.901	1.300	0.933	1.058	0.799
		10	1.280	0.919	1.149	0.850	1.295	0.928	1.199	0.891	1.387	0.972	1.193	0.866	1.233	0.909	1.306	0.939	1.091	0.829
		12	1.264	0.904	1.205	0.875	1.258	0.909	1.176	0.882	1.369	0.965	1.202	0.866	1.196	0.897	1.292	0.933	1.041	0.803
		Avg	1.289	0.919	1.165	0.854	1.283	0.921	1.151	0.864	1.368	0.961	1.168	0.850	1.199	0.900	1.296	0.933	1.062	0.807
	MM-TSFLib	6	1.109	0.859	1.162	0.839	1.110	0.855	0.997	0.801	1.181	0.880	1.130	0.832	1.060	0.850	1.129	0.871	1.037	0.789
		8	1.159	0.869	1.114	0.830	1.096	0.850	1.017	0.809	1.190	0.896	1.096	0.821	1.137	0.873	1.145	0.870	1.049	0.799
		10	1.119	0.852	1.111	0.834	1.099	0.848	1.065	0.835	1.205	0.902	1.087	0.820	1.111	0.860	1.163	0.876	1.018	0.792
		12	1.145	0.869	1.104	0.835	1.105	0.846	1.071	0.834	1.189	0.897	1.116	0.834	1.117	0.864	1.152	0.875	1.034	0.801
		Avg	1.133	0.862	1.123	0.835	1.103	0.850	1.037	0.820	1.191	0.894	1.107	0.827	1.106	0.862	1.147	0.873	1.035	0.795
	TaTS	6	1.021	0.820	1.027	0.778	0.929	0.771	0.910	0.764	0.969	0.784	1.037	0.792	0.988	0.800	0.974	0.793	0.914	0.740
		8	0.975	0.795	1.020	0.782	0.942	0.776	0.960	0.786	0.974	0.793	0.982	0.776	1.018	0.807	0.986	0.788	0.934	0.748
		10	1.013	0.815	1.029	0.790	0.963	0.783	0.991	0.795	0.997	0.803	1.000	0.782	1.021	0.808	1.023	0.808	0.999	0.779
		12	0.965	0.787	1.054	0.804	0.967	0.781	0.996	0.806	1.002	0.806	1.047	0.803	1.045	0.822	1.021	0.809	0.978	0.777
		Avg	0.993	0.804	1.033	0.789	0.950	0.778	0.964	0.788	0.986	0.797	1.017	0.788	1.018	0.809	1.001	0.800	0.956	0.761
	PA-RNet	6	1.000	0.810	0.994	0.772	0.924	0.768	0.918	0.765	0.971	0.784	0.961	0.770	0.995	0.798	0.950	0.780	0.916	0.736
		8	0.930	0.779	1.031	0.785	0.940	0.774	0.938	0.776	0.970	0.791	0.962	0.767	0.994	0.795	0.973	0.785	0.955	0.757
		10	0.982	0.807	1.016	0.785	0.960	0.782	0.987	0.804	0.992	0.801	0.955	0.765	1.030	0.812	1.015	0.806	0.989	0.777
		12	0.974	0.793	1.017	0.787	0.968	0.782	0.984	0.797	1.001	0.805	0.980	0.777	1.043	0.821	1.029	0.812	1.022	0.795
		Avg	0.972	0.797	1.015	0.782	0.948	0.777	0.957	0.786	0.983	0.795	0.965	0.770	1.016	0.807	0.992	0.796	0.970	0.766
Economy	Uni-modal	6	0.085	0.234	0.265	0.440	0.094	0.257	0.096	0.234	0.017	0.103	0.496	0.665	0.016	0.098	0.020	0.108	0.207	0.351
		8	0.097	0.247	0.344	0.531	0.101	0.271	0.072	0.210	0.018	0.109	0.580	0.722	0.016	0.098	0.019	0.109	0.119	0.268
		10	0.075	0.213	0.817	0.776	0.116	0.288	0.064	0.199	0.018	0.109	0.530	0.687	0.016	0.098	0.018	0.105	0.121	0.270
		12	0.074	0.216	0.837	0.821	0.141	0.309	0.077	0.221	0.018	0.110	0.680	0.776	0.016	0.099	0.018	0.105	0.071	0.216
		Avg	0.083	0.227	0.566	0.642	0.113	0.281	0.077	0.216	0.018	0.108	0.572	0.712	0.016	0.098	0.019	0.107	0.129	0.276
	MM-TSFLib	6	0.099	0.246	0.334	0.440	0.047	0.174	0.081	0.220	0.017	0.104	0.403	0.591	0.016	0.096	0.020	0.109	0.141	0.296
		8	0.083	0.222	0.300	0.424	0.054	0.184	0.070	0.205	0.018	0.109	0.436	0.620	0.016	0.096	0.019	0.108	0.174	0.344
		10	0.074	0.213	0.435	0.601	0.048	0.171	0.061	0.195	0.018	0.108	0.568	0.710	0.016	0.100	0.018	0.105	0.161	0.328
		12	0.077	0.212	0.452	0.602	0.052	0.173	0.069	0.208	0.018	0.110	0.551	0.693	0.016	0.098	0.018	0.107	0.193	0.370
		Avg	0.083	0.223	0.380	0.517	0.050	0.176	0.070	0.207	0.018	0.108	0.490	0.654	0.016	0.098	0.019	0.107	0.167	0.335
	TaTS	6	0.030	0.139	0.092	0.259	0.017	0.106	0.040	0.153	0.011	0.087	0.210	0.416	0.011	0.087	0.011	0.086	0.064	0.208
		8	0.033	0.145	0.160	0.363	0.016	0.103	0.037	0.145	0.010	0.085	0.294	0.495	0.011	0.085	0.011	0.087	0.100	0.267
		10	0.026	0.126	0.214	0.410	0.015	0.099	0.030	0.132	0.010	0.084	0.348	0.557	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.022	0.119	0.221	0.418	0.015	0.099	0.038	0.150	0.010	0.083	0.389	0.587	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.028	0.132	0.172	0.363	0.016	0.102	0.036	0.145	0.010	0.085	0.310	0.514	0.011	0.085	0.011	0.086	0.133	0.311
	PA-RNet	6	0.027	0.129	0.069	0.221	0.018	0.108	0.036	0.144	0.011	0.086	0.147	0.338	0.011	0.085	0.011	0.087	0.054	0.186
		8	0.024	0.124	0.132	0.318	0.016	0.103	0.035	0.142	0.010	0.085	0.246	0.454	0.010	0.085	0.011	0.087	0.085	0.244
		10	0.023	0.122	0.211	0.413	0.015	0.099	0.032	0.134	0.010	0.084	0.346	0.550	0.010	0.084	0.010	0.085	0.142	0.333
		12	0.023	0.121	0.216	0.417	0.015	0.099	0.038	0.146	0.010	0.083	0.453	0.631	0.010	0.082	0.010	0.084	0.172	0.358
		Avg	0.024	0.124	0.157	0.342	0.016	0.102	0.035	0.142	0.010	0.085	0.298	0.493	0.010	0.084	0.011	0.086	0.113	0.280

Table 8: Detailed forecasting results on Energy, Environment, and Health under the original noisy textual conditions. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Energy	Uni-modal	12	0.177	0.321	0.142	0.273	0.104	0.229	0.097	0.218	0.101	0.225	0.200	0.314	0.125	0.263	0.146	0.283	0.179	0.297
		24	0.334	0.455	0.297	0.413	0.211	0.331	0.180	0.307	0.217	0.340	0.320	0.442	0.253	0.381	0.254	0.382	0.277	0.402
		36	0.403	0.503	0.403	0.487	0.293	0.391	0.253	0.372	0.310	0.412	0.476	0.543	0.326	0.438	0.352	0.460	0.493	0.537
		48	0.513	0.567	0.481	0.542	0.401	0.466	0.366	0.470	0.415	0.491	0.551	0.605	0.447	0.530	0.449	0.530	0.528	0.589
		Avg	0.357	0.461	0.331	0.429	0.252	0.354	0.224	0.342	0.261	0.367	0.387	0.476	0.288	0.403	0.300	0.414	0.369	0.456
	MM-TSFLib	12	0.168	0.315	0.131	0.257	0.106	0.232	0.090	0.212	0.099	0.221	0.209	0.342	0.135	0.278	0.135	0.272	0.220	0.344
		24	0.330	0.453	0.247	0.370	0.211	0.332	0.176	0.306	0.207	0.333	0.330	0.444	0.233	0.366	0.249	0.375	0.349	0.448
		36	0.407	0.506	0.398	0.488	0.293	0.394	0.258	0.375	0.307	0.409	0.445	0.532	0.326	0.438	0.343	0.449	0.373	0.478
		48	0.497	0.561	0.504	0.562	0.402	0.474	0.364	0.462	0.413	0.492	0.548	0.598	0.435	0.519	0.447	0.528	0.501	0.573
		Avg	0.351	0.459	0.320	0.419	0.253	0.358	0.222	0.339	0.257	0.364	0.383	0.479	0.282	0.400	0.294	0.406	0.361	0.461
	TaTS	12	0.172	0.309	0.143	0.276	0.106	0.232	0.119	0.251	0.099	0.221	0.211	0.306	0.142	0.279	0.137	0.277	0.156	0.282
		24	0.316	0.436	0.332	0.418	0.213	0.336	0.197	0.332	0.226	0.351	0.399	0.471	0.250	0.376	0.246	0.375	0.268	0.382
		36	0.397	0.495	0.375	0.468	0.291	0.393	0.263	0.387	0.305	0.407	0.448	0.528	0.339	0.446	0.346	0.453	0.391	0.478
		48	0.489	0.566	0.491	0.548	0.399	0.469	0.376	0.487	0.412	0.492	0.449	0.540	0.451	0.529	0.439	0.526	0.468	0.547
		Avg	0.344	0.452	0.335	0.428	0.252	0.358	0.239	0.364	0.261	0.368	0.377	0.461	0.296	0.408	0.292	0.408	0.321	0.422
	PA-RNet	12	0.166	0.304	0.158	0.289	0.104	0.228	0.105	0.234	0.100	0.219	0.240	0.344	0.130	0.265	0.125	0.262	0.162	0.294
		24	0.333	0.452	0.270	0.384	0.208	0.330	0.192	0.327	0.205	0.329	0.311	0.435	0.226	0.359	0.251	0.381	0.248	0.372
		36	0.402	0.492	0.362	0.457	0.293	0.392	0.264	0.390	0.295	0.396	0.384	0.494	0.330	0.441	0.331	0.444	0.347	0.455
		48	0.492	0.566	0.504	0.552	0.401	0.471	0.384	0.491	0.409	0.489	0.463	0.558	0.437	0.525	0.448	0.533	0.447	0.529
		Avg	0.348	0.454	0.324	0.421	0.252	0.355	0.236	0.361	0.252	0.358	0.350	0.458	0.281	0.397	0.289	0.405	0.301	0.413
Environment	Uni-modal	48	0.414	0.501	0.322	0.429	0.372	0.497	0.351	0.450	0.309	0.389	0.346	0.456	0.278	0.385	0.318	0.398	0.317	0.442
		96	0.406	0.504	0.365	0.472	0.527	0.620	0.404	0.499	0.335	0.399	0.457	0.544	0.282	0.390	0.341	0.411	0.402	0.501
		192	0.544	0.612	0.561	0.603	0.679	0.732	0.445	0.528	0.334	0.395	0.474	0.547	0.283	0.395	0.348	0.425	0.436	0.505
		336	0.400	0.494	0.529	0.592	0.550	0.628	0.345	0.458	0.303	0.384	0.473	0.541	0.269	0.384	0.313	0.409	0.380	0.474
		Avg	0.441	0.528	0.444	0.524	0.532	0.619	0.386	0.484	0.320	0.392	0.438	0.522	0.278	0.389	0.330	0.411	0.384	0.481
	MM-TSFLib	48	0.370	0.452	0.314	0.415	0.337	0.465	0.317	0.421	0.301	0.395	0.346	0.460	0.286	0.393	0.304	0.396	0.309	0.424
		96	0.416	0.494	0.332	0.442	0.443	0.557	0.361	0.471	0.311	0.391	0.386	0.494	0.292	0.397	0.328	0.414	0.360	0.467
		192	0.435	0.527	0.490	0.578	0.555	0.647	0.377	0.481	0.308	0.385	0.463	0.536	0.286	0.397	0.324	0.415	0.403	0.496
		336	0.353	0.451	0.428	0.531	0.475	0.573	0.345	0.459	0.285	0.379	0.426	0.513	0.277	0.389	0.304	0.406	0.351	0.454
		Avg	0.394	0.481	0.391	0.492	0.453	0.561	0.350	0.458	0.301	0.388	0.405	0.501	0.285	0.394	0.315	0.408	0.356	0.460
	TaTS	48	0.316	0.421	0.279	0.379	0.274	0.391	0.281	0.385	0.269	0.374	0.278	0.384	0.265	0.368	0.270	0.374	0.281	0.381
		96	0.300	0.402	0.287	0.401	0.306	0.435	0.291	0.395	0.277	0.374	0.307	0.419	0.266	0.370	0.278	0.377	0.288	0.404
		192	0.334	0.443	0.315	0.448	0.338	0.482	0.286	0.399	0.268	0.365	0.292	0.417	0.256	0.368	0.269	0.372	0.272	0.396
		336	0.297	0.416	0.311	0.444	0.315	0.454	0.270	0.378	0.259	0.364	0.285	0.414	0.252	0.367	0.260	0.370	0.279	0.395
		Avg	0.312	0.421	0.298	0.418	0.308	0.441	0.282	0.389	0.268	0.369	0.291	0.409	0.260	0.368	0.269	0.373	0.280	0.394
	PA-RNet	48	0.302	0.399	0.279	0.388	0.273	0.390	0.286	0.383	0.269	0.374	0.288	0.385	0.265	0.371	0.270	0.372	0.276	0.376
		96	0.313	0.408	0.286	0.398	0.305	0.433	0.294	0.397	0.277	0.374	0.282	0.396	0.264	0.370	0.276	0.374	0.273	0.381
		192	0.325	0.443	0.311	0.445	0.338	0.481	0.285	0.400	0.268	0.365	0.271	0.399	0.256	0.372	0.269	0.375	0.279	0.400
		336	0.292	0.413	0.302	0.433	0.315	0.454	0.269	0.384	0.260	0.365	0.277	0.397	0.251	0.369	0.260	0.370	0.280	0.406
		Avg	0.308	0.416	0.295	0.416	0.308	0.439	0.284	0.391	0.269	0.370	0.279	0.394	0.259	0.371	0.269	0.373	0.277	0.391
Health	Uni-modal	12	1.512	0.919	1.166	0.722	1.487	0.824	1.131	0.787	1.244	0.749	1.250	0.765	1.061	0.626	0.962	0.624	1.358	0.803
		24	1.875	1.025	1.404	0.785	1.636	0.866	1.549	0.964	1.525	0.832	1.642	0.819	1.811	0.784	1.578	0.758	1.393	0.761
		36	1.971	1.040	1.452	0.801	1.673	0.885	1.622	0.982	1.692	0.891	1.534	0.824	2.187	0.885	1.908	0.857	1.555	0.793
		48	1.881	0.987	1.493	0.814	1.717	0.906	1.647	0.980	1.790	0.931	1.662	0.865	2.240	0.928	2.131	0.911	1.533	0.835
		Avg	1.810	0.993	1.379	0.781	1.628	0.870	1.487	0.928	1.563	0.851	1.522	0.818	1.825	0.806	1.645	0.788	1.460	0.798
	MM-TSFLib	12	1.525	0.905	1.054	0.691	1.415	0.806	1.141	0.779	1.185	0.730	1.101	0.720	0.994	0.623	0.878	0.602	1.169	0.764
		24	1.757	0.965	1.352	0.774	1.536	0.824	1.442	0.905	1.449	0.813	1.411	0.771	1.619	0.766	1.360	0.723	1.275	0.707
		36	1.778	0.966	1.393	0.772	1.580	0.853	1.476	0.911	1.564	0.846	1.464	0.792	1.864	0.840	1.679	0.816	1.292	0.769
		48	1.808	0.955	1.482	0.800	1.626	0.877	1.503	0.908	1.653	0.884	1.544	0.821	1.975	0.894	1.850	0.869	1.411	0.781
		Avg	1.717	0.948	1.320	0.759	1.539	0.840	1.391	0.876	1.463	0.818	1.380	0.776	1.613	0.781	1.442	0.753	1.287	0.755
	TaTS	12	1.372	0.865	1.032	0.696	1.282	0.765	1.127	0.770	1.123	0.711	1.009	0.689	0.917	0.612	0.795	0.594	0.913	0.641
		24	1.508	0.894	1.249	0.740	1.399	0.790	1.380	0.864	1.362	0.786	1.184	0.724	1.299	0.720	1.198	0.707	1.126	0.710
		36	1.551	0.888	1.295	0.743	1.449	0.809	1.424	0.867	1.421	0.801	1.213	0.733	1.577	0.808	1.453	0.777	1.190	0.717
		48	1.531	0.885	1.346	0.769	1.504	0.834	1.476	0.889	1.495	0.837	1.305	0.778	1.707	0.852	1.592	0.822	1.294	0.751
		Avg	1.491	0.883	1.231	0.737	1.409	0.800	1.352	0.847	1.350	0.784	1.178	0.731	1.375	0.748	1.260	0.725	1.131	0.705
	PA-RNet	12	1.320	0.846	0.999	0.672	1.287	0.766	1.118	0.765	1.125	0.712	0.960	0.672	0.919	0.623	0.783	0.592	0.882	0.636
		24	1.476	0.884	1.270	0.737	1.398	0.789	1.337	0.845	1.344	0.775	1.133	0.702	1.253	0.708	1.149	0.693	1.157	0.706
		36	1.583	0.902	1.268	0.737	1.442	0.810	1.414	0.863	1.420	0.801	1.228	0.736	1.560	0.808	1.446	0.777	1.173	0.708
		48	1.531	0.866	1.353	0.754	1.509	0.830	1.461	0.880	1.499	0.838	1.313	0.772	1.661	0.847	1.619	0.827	1.293	0.748
		Avg	1.478	0.875	1.223	0.725	1.409	0.799	1.333	0.838	1.347	0.782	1.158	0.721	1.348	0.747	1.249	0.722	1.126	0.700

Table 9: Detailed forecasting results on Security, Social Good, and Traffic under the original noisy textual conditions. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Security	Uni-modal	6	125.784	5.469	126.449	6.161	104.875	4.960	144.717	5.981	119.227	5.555	126.891	6.277	104.867	4.791	126.968	6.145	123.389	5.983
		8	125.874	5.406	127.465	6.308	108.280	5.126	132.596	5.584	130.614	6.380	129.400	6.504	106.625	4.888	125.737	5.985	126.223	6.239
		10	126.364	5.435	125.520	6.214	111.262	5.324	128.839	5.569	133.139	6.528	132.062	6.720	108.510	4.958	124.925	5.909	127.792	6.381
		12	122.761	5.364	126.094	6.292	113.018	5.374	126.916	5.537	134.097	6.572	133.043	6.809	112.233	5.167	126.309	6.016	128.924	6.481
		Avg	125.196	5.419	126.382	6.244	109.359	5.196	133.267	5.668	129.269	6.259	130.349	6.578	108.059	4.951	125.985	6.014	126.582	6.271
	MM-TSFLib	6	135.978	5.781	127.760	6.294	103.672	4.689	141.976	5.859	113.719	5.244	127.575	6.324	104.461	4.675	126.347	6.049	125.458	6.099
		8	126.216	5.516	126.442	6.278	106.651	4.847	130.631	5.482	119.563	5.794	129.197	6.494	106.234	4.793	124.963	5.942	126.861	6.233
		10	118.199	5.262	128.990	6.474	108.939	4.990	128.098	5.581	121.655	5.930	132.045	6.729	109.357	4.869	126.263	6.013	129.091	6.453
		12	120.713	5.480	130.396	6.594	110.493	5.050	127.225	5.645	122.635	5.957	132.481	6.770	111.548	5.012	129.346	6.179	130.061	6.531
		Avg	125.277	5.510	128.397	6.410	107.439	4.894	131.983	5.642	119.393	5.731	130.325	6.579	107.900	4.837	126.730	6.046	127.868	6.329
	TaTS	6	111.230	5.005	127.679	6.235	103.634	4.692	108.423	4.762	113.364	5.067	122.336	5.932	102.905	4.572	125.216	6.110	124.067	5.930
		8	109.463	4.916	126.774	6.283	106.609	4.848	109.324	4.922	112.915	5.140	123.902	6.119	105.891	4.750	123.466	5.884	120.704	5.710
		10	109.924	4.883	125.433	6.220	108.898	4.987	108.781	4.975	113.621	5.222	125.957	6.313	108.922	4.903	125.585	5.943	122.724	5.892
		12	111.355	4.945	125.660	6.238	110.411	5.039	108.918	5.008	114.169	5.235	126.504	6.374	110.215	4.987	128.161	6.086	123.298	5.895
		Avg	110.493	4.937	126.387	6.244	107.388	4.892	108.862	4.917	113.517	5.166	124.675	6.185	106.983	4.803	125.607	6.006	122.698	5.857
	PA-RNet	6	111.166	4.954	125.528	6.097	103.637	4.693	108.168	4.768	113.308	5.067	123.371	5.998	103.134	4.648	124.760	6.101	122.271	5.824
		8	109.434	4.923	127.559	6.324	106.600	4.848	109.545	4.923	112.907	5.142	124.953	6.188	106.473	4.807	121.212	5.822	124.400	5.958
		10	110.855	4.923	125.359	6.207	108.891	4.988	108.450	4.955	113.676	5.225	124.844	6.251	109.741	5.083	124.635	5.933	123.271	5.982
		12	109.952	4.873	125.874	6.251	110.403	5.038	108.624	4.997	114.053	5.236	126.576	6.382	110.437	5.020	126.371	6.031	123.082	5.922
		Avg	110.352	4.918	126.080	6.220	107.383	4.892	108.697	4.911	113.486	5.167	124.936	6.205	107.446	4.890	124.245	5.972	123.256	5.922
Social Good	Uni-modal	6	1.026	0.557	0.765	0.428	0.928	0.519	0.945	0.464	0.885	0.424	0.759	0.388	1.083	0.562	0.914	0.474	0.732	0.392
		8	1.095	0.585	0.833	0.455	1.018	0.562	1.170	0.510	1.080	0.497	0.791	0.412	1.155	0.568	1.046	0.526	0.814	0.422
		10	1.144	0.596	0.892	0.500	1.057	0.585	1.251	0.546	1.208	0.576	0.827	0.426	1.171	0.603	1.094	0.526	0.830	0.445
		12	1.247	0.634	0.926	0.501	1.159	0.629	1.352	0.589	1.300	0.600	0.845	0.461	1.248	0.637	1.152	0.541	0.898	0.449
		Avg	1.128	0.593	0.854	0.471	1.041	0.574	1.180	0.527	1.118	0.524	0.805	0.422	1.164	0.593	1.052	0.517	0.819	0.427
	MM-TSFLib	6	0.989	0.557	0.754	0.427	0.946	0.536	0.925	0.475	0.874	0.472	0.752	0.386	1.023	0.491	0.991	0.541	0.773	0.401
		8	1.028	0.564	0.843	0.480	0.991	0.559	1.113	0.518	1.016	0.527	0.779	0.424	0.996	0.519	1.027	0.553	0.818	0.423
		10	1.122	0.606	0.874	0.487	1.050	0.593	1.191	0.570	1.100	0.558	0.831	0.456	1.050	0.543	0.995	0.503	0.845	0.453
		12	1.209	0.672	0.911	0.514	1.111	0.626	1.283	0.601	1.169	0.589	0.838	0.460	1.121	0.585	1.136	0.579	0.862	0.462
		Avg	1.087	0.600	0.846	0.477	1.025	0.579	1.128	0.541	1.040	0.537	0.800	0.432	1.047	0.535	1.037	0.544	0.825	0.435
	TaTS	6	0.958	0.529	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.753	0.376	1.055	0.645	0.875	0.450	0.777	0.399
		8	1.040	0.592	0.819	0.462	1.030	0.575	1.056	0.557	1.013	0.509	0.805	0.410	1.105	0.667	1.025	0.533	0.840	0.423
		10	1.110	0.629	0.884	0.496	1.044	0.585	1.131	0.603	1.108	0.556	0.895	0.455	1.160	0.699	1.067	0.528	0.856	0.429
		12	1.157	0.641	0.923	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.853	0.451	1.195	0.708	1.178	0.538	0.854	0.456
		Avg	1.066	0.598	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.827	0.423	1.129	0.680	1.036	0.512	0.832	0.427
	PA-RNet	6	0.967	0.533	0.756	0.419	0.917	0.522	0.928	0.513	0.854	0.429	0.723	0.392	1.141	0.607	0.970	0.523	0.747	0.391
		8	1.062	0.608	0.826	0.448	1.004	0.563	1.082	0.563	0.998	0.497	0.815	0.394	1.080	0.564	0.995	0.473	0.772	0.410
		10	1.108	0.608	0.896	0.497	1.034	0.578	1.111	0.580	1.104	0.551	0.843	0.416	1.230	0.603	1.072	0.496	0.825	0.428
		12	1.156	0.636	0.897	0.481	1.109	0.612	1.198	0.620	1.176	0.581	0.859	0.466	1.191	0.598	1.128	0.536	0.895	0.474
		Avg	1.073	0.596	0.844	0.461	1.016	0.569	1.080	0.569	1.033	0.515	0.810	0.417	1.161	0.593	1.041	0.507	0.810	0.426
Traffic	Uni-modal	6	0.178	0.265	0.190	0.320	0.342	0.458	0.186	0.265	0.261	0.365	0.145	0.280	0.168	0.233	0.168	0.233	0.153	0.268
		8	0.160	0.243	0.193	0.322	0.316	0.434	0.185	0.264	0.241	0.318	0.159	0.302	0.181	0.235	0.178	0.237	0.150	0.265
		10	0.196	0.288	0.195	0.313	0.305	0.421	0.186	0.263	0.237	0.307	0.152	0.279	0.186	0.237	0.187	0.238	0.156	0.275
		12	0.243	0.297	0.224	0.318	0.337	0.438	0.256	0.304	0.276	0.328	0.198	0.320	0.243	0.263	0.239	0.259	0.192	0.282
		Avg	0.194	0.273	0.201	0.318	0.325	0.438	0.203	0.274	0.254	0.330	0.163	0.295	0.194	0.242	0.193	0.242	0.163	0.273
	MM-TSFLib	6	0.164	0.253	0.180	0.306	0.251	0.381	0.166	0.244	0.238	0.335	0.159	0.298	0.165	0.238	0.160	0.230	0.149	0.262
		8	0.158	0.244	0.189	0.318	0.245	0.368	0.169	0.244	0.224	0.309	0.161	0.298	0.182	0.243	0.170	0.235	0.157	0.274
		10	0.171	0.267	0.190	0.311	0.224	0.348	0.174	0.247	0.218	0.298	0.164	0.300	0.186	0.244	0.180	0.240	0.157	0.274
		12	0.230	0.288	0.218	0.313	0.251	0.358	0.238	0.290	0.266	0.325	0.201	0.317	0.245	0.276	0.238	0.272	0.196	0.284
		Avg	0.181	0.263	0.194	0.312	0.243	0.364	0.187	0.256	0.237	0.317	0.171	0.303	0.194	0.250	0.187	0.244	0.165	0.274
	TaTS	6	0.141	0.207	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.139	0.254	0.159	0.211	0.149	0.206	0.138	0.244
		8	0.145	0.213	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.143	0.268	0.168	0.215	0.161	0.211	0.142	0.254
		10	0.151	0.218	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.145	0.266	0.172	0.218	0.169	0.217	0.144	0.255
		12	0.212	0.256	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.182	0.296	0.229	0.245	0.226	0.242	0.180	0.270
		Avg	0.162	0.224	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.152	0.271	0.182	0.222	0.176	0.219	0.151	0.256
	PA-RNet	6	0.142	0.211	0.156	0.276	0.190	0.311	0.152	0.215	0.171	0.272	0.140	0.247	0.152	0.208	0.148	0.205	0.142	0.236
		8	0.147	0.210	0.161	0.280	0.187	0.306	0.152	0.211	0.172	0.248	0.146	0.265	0.165	0.215	0.160	0.213	0.145	0.242
		10	0.151	0.216	0.164	0.284	0.189	0.310	0.159	0.223	0.173	0.246	0.156	0.285	0.168	0.216	0.168	0.215	0.148	0.242
		12	0.208	0.249	0.194	0.290	0.217	0.313	0.216	0.258	0.217	0.261	0.180	0.276	0.227	0.245	0.225	0.242	0.184	0.256
		Avg	0.162	0.222	0.169	0.283	0.196	0.310	0.170	0.227	0.183	0.257	0.156	0.268	0.178	0.221	0.175	0.219	0.155	0.244

Table 10: Detailed forecasting results on Agriculture, Climate, and Economy under textual perturbation ratio $\rho = 0.3$. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Uni-modal	6	0.078	0.205	0.173	0.303	0.156	0.302	0.074	0.195	0.066	0.160	0.272	0.384	0.067	0.180	0.059	0.160	0.199	0.315
		8	0.091	0.217	0.266	0.373	0.173	0.320	0.090	0.219	0.084	0.183	0.315	0.403	0.079	0.188	0.079	0.183	0.208	0.311
		10	0.110	0.248	0.362	0.450	0.206	0.343	0.105	0.247	0.108	0.209	0.490	0.530	0.102	0.219	0.101	0.206	0.305	0.390
		12	0.134	0.269	0.436	0.495	0.247	0.371	0.132	0.273	0.142	0.241	0.578	0.567	0.134	0.247	0.131	0.238	0.419	0.451
		Avg	0.103	0.235	0.309	0.405	0.195	0.334	0.100	0.234	0.100	0.198	0.414	0.471	0.096	0.209	0.093	0.197	0.283	0.367
	MM-TSFLib	6	0.076	0.199	0.138	0.260	0.094	0.211	0.073	0.194	0.067	0.161	0.211	0.328	0.072	0.200	0.061	0.163	0.158	0.276
		8	0.093	0.223	0.241	0.357	0.127	0.252	0.091	0.219	0.085	0.184	0.284	0.392	0.092	0.221	0.078	0.182	0.214	0.323
		10	0.108	0.249	0.274	0.373	0.154	0.274	0.108	0.247	0.110	0.211	0.386	0.455	0.109	0.244	0.098	0.204	0.257	0.351
		12	0.133	0.273	0.336	0.409	0.193	0.296	0.134	0.268	0.139	0.236	0.517	0.538	0.135	0.262	0.131	0.235	0.290	0.363
		Avg	0.103	0.236	0.247	0.350	0.142	0.258	0.101	0.232	0.100	0.198	0.350	0.428	0.102	0.232	0.092	0.196	0.230	0.328
	TaTS	6	0.072	0.193	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.122	0.257	0.064	0.175	0.060	0.161	0.096	0.249
		8	0.096	0.222	0.155	0.275	0.133	0.264	0.089	0.222	0.083	0.181	0.159	0.280	0.080	0.192	0.078	0.181	0.125	0.267
		10	0.111	0.252	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.230	0.327	0.100	0.213	0.100	0.204	0.177	0.290
		12	0.138	0.274	0.255	0.339	0.194	0.308	0.131	0.271	0.139	0.236	0.335	0.398	0.131	0.241	0.131	0.235	0.233	0.322
		Avg	0.104	0.235	0.177	0.287	0.152	0.277	0.101	0.236	0.099	0.196	0.212	0.316	0.094	0.205	0.092	0.195	0.158	0.282
	PA-RNet	6	0.076	0.194	0.093	0.220	0.118	0.249	0.074	0.191	0.065	0.159	0.111	0.247	0.064	0.177	0.060	0.161	0.101	0.251
		8	0.091	0.220	0.146	0.261	0.135	0.264	0.088	0.215	0.084	0.182	0.161	0.289	0.081	0.193	0.077	0.181	0.121	0.263
		10	0.106	0.244	0.197	0.293	0.158	0.283	0.107	0.239	0.108	0.208	0.227	0.324	0.101	0.212	0.099	0.203	0.169	0.292
		12	0.137	0.274	0.252	0.329	0.190	0.307	0.131	0.267	0.139	0.235	0.316	0.385	0.131	0.246	0.129	0.236	0.234	0.320
		Avg	0.103	0.233	0.172	0.276	0.150	0.276	0.100	0.228	0.099	0.196	0.204	0.311	0.094	0.207	0.091	0.195	0.156	0.282
Climate	Uni-modal	6	1.315	0.930	1.151	0.844	1.309	0.929	1.093	0.834	1.337	0.940	1.118	0.821	1.160	0.892	1.285	0.925	1.058	0.798
		8	1.296	0.924	1.153	0.846	1.270	0.918	1.136	0.849	1.380	0.967	1.158	0.845	1.206	0.901	1.300	0.933	1.058	0.799
		10	1.280	0.919	1.149	0.850	1.295	0.928	1.199	0.891	1.387	0.972	1.193	0.866	1.233	0.909	1.306	0.939	1.091	0.829
		12	1.264	0.904	1.205	0.875	1.258	0.909	1.176	0.882	1.369	0.965	1.202	0.866	1.196	0.897	1.292	0.933	1.041	0.803
		Avg	1.289	0.919	1.165	0.854	1.283	0.921	1.151	0.864	1.368	0.961	1.168	0.850	1.199	0.900	1.296	0.933	1.062	0.807
	MM-TSFLib	6	1.110	0.859	1.165	0.840	1.108	0.855	1.001	0.801	1.185	0.883	1.112	0.826	1.058	0.848	1.130	0.872	1.037	0.789
		8	1.121	0.858	1.111	0.828	1.091	0.848	1.029	0.814	1.189	0.896	1.094	0.820	1.137	0.874	1.150	0.872	1.048	0.799
		10	1.139	0.860	1.112	0.834	1.096	0.848	1.072	0.838	1.205	0.902	1.089	0.822	1.110	0.860	1.170	0.879	1.027	0.796
		12	1.142	0.862	1.110	0.837	1.109	0.848	1.073	0.836	1.189	0.897	1.135	0.840	1.117	0.864	1.154	0.875	1.036	0.802
		Avg	1.128	0.860	1.125	0.835	1.101	0.850	1.044	0.822	1.192	0.895	1.108	0.827	1.106	0.861	1.151	0.875	1.037	0.797
	TaTS	6	1.024	0.819	1.027	0.778	0.929	0.771	0.909	0.765	0.969	0.784	1.001	0.776	0.982	0.793	0.974	0.793	0.914	0.740
		8	0.997	0.808	1.020	0.782	0.942	0.776	0.942	0.775	0.974	0.793	0.990	0.779	1.016	0.806	0.986	0.788	0.934	0.749
		10	1.006	0.813	1.029	0.790	0.963	0.783	0.997	0.800	0.997	0.803	1.004	0.782	1.022	0.809	1.023	0.808	0.998	0.778
		12	0.974	0.792	1.054	0.804	0.967	0.781	0.997	0.809	1.002	0.806	1.053	0.806	1.049	0.823	1.021	0.809	0.978	0.777
		Avg	1.000	0.808	1.033	0.789	0.950	0.778	0.961	0.787	0.986	0.797	1.012	0.786	1.017	0.808	1.001	0.800	0.956	0.761
	PA-RNet	6	1.021	0.821	0.994	0.772	0.924	0.768	0.918	0.765	0.971	0.784	0.976	0.779	0.995	0.797	0.950	0.780	0.910	0.735
		8	0.952	0.792	1.031	0.785	0.940	0.774	0.939	0.776	0.970	0.791	0.964	0.770	0.992	0.794	0.973	0.785	0.951	0.756
		10	0.976	0.804	1.016	0.785	0.960	0.782	0.987	0.804	0.992	0.801	0.964	0.770	1.029	0.812	1.015	0.806	0.994	0.781
		12	0.969	0.790	1.017	0.787	0.968	0.782	0.984	0.797	1.001	0.805	0.979	0.778	1.035	0.817	1.029	0.812	0.993	0.783
		Avg	0.979	0.802	1.015	0.782	0.948	0.777	0.957	0.786	0.983	0.795	0.971	0.774	1.013	0.805	0.992	0.796	0.962	0.764
Economy	Uni-modal	6	0.085	0.234	0.265	0.440	0.094	0.257	0.096	0.234	0.017	0.103	0.496	0.665	0.016	0.098	0.020	0.108	0.207	0.351
		8	0.097	0.247	0.344	0.531	0.101	0.271	0.072	0.210	0.018	0.109	0.580	0.722	0.016	0.098	0.019	0.109	0.119	0.268
		10	0.075	0.213	0.817	0.776	0.116	0.288	0.064	0.199	0.018	0.109	0.530	0.687	0.016	0.098	0.018	0.105	0.121	0.270
		12	0.074	0.216	0.837	0.821	0.141	0.309	0.077	0.221	0.018	0.110	0.680	0.776	0.016	0.099	0.018	0.105	0.071	0.216
		Avg	0.083	0.227	0.566	0.642	0.113	0.281	0.077	0.216	0.018	0.108	0.572	0.712	0.016	0.098	0.019	0.107	0.129	0.276
	MM-TSFLib	6	0.092	0.239	0.373	0.475	0.047	0.174	0.081	0.220	0.017	0.104	0.411	0.591	0.016	0.096	0.020	0.109	0.143	0.297
		8	0.085	0.227	0.239	0.405	0.054	0.184	0.070	0.205	0.018	0.109	0.429	0.615	0.016	0.096	0.019	0.108	0.170	0.337
		10	0.076	0.216	0.456	0.604	0.056	0.184	0.061	0.195	0.018	0.108	0.554	0.696	0.016	0.100	0.018	0.105	0.168	0.345
		12	0.082	0.218	0.565	0.714	0.050	0.169	0.069	0.208	0.018	0.110	0.546	0.690	0.016	0.098	0.018	0.107	0.177	0.352
		Avg	0.084	0.225	0.408	0.550	0.052	0.178	0.070	0.207	0.018	0.108	0.485	0.648	0.016	0.098	0.019	0.107	0.164	0.333
	TaTS	6	0.027	0.130	0.093	0.259	0.017	0.106	0.040	0.153	0.011	0.087	0.201	0.406	0.011	0.084	0.011	0.086	0.064	0.208
		8	0.029	0.137	0.115	0.292	0.016	0.103	0.037	0.145	0.010	0.085	0.295	0.497	0.011	0.085	0.011	0.087	0.100	0.266
		10	0.024	0.123	0.214	0.415	0.015	0.099	0.030	0.132	0.010	0.084	0.346	0.556	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.022	0.118	0.222	0.415	0.015	0.099	0.038	0.150	0.010	0.083	0.389	0.588	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.026	0.127	0.161	0.345	0.016	0.102	0.036	0.145	0.010	0.085	0.308	0.512	0.011	0.084	0.011	0.086	0.133	0.311
	PA-RNet	6	0.027	0.129	0.076	0.231	0.018	0.108	0.036	0.144	0.011	0.086	0.150	0.342	0.011	0.085	0.011	0.087	0.076	0.231
		8	0.026	0.127	0.123	0.303	0.016	0.103	0.035	0.142	0.010	0.085	0.268	0.478	0.010	0.085	0.011	0.087	0.128	0.309
		10	0.023	0.122	0.154	0.340	0.015	0.099	0.032	0.134	0.010	0.084	0.343	0.546	0.010	0.084	0.010	0.085	0.126	0.310
		12	0.021	0.116	0.205	0.403	0.015	0.099	0.038	0.146	0.010	0.083	0.454	0.632	0.010	0.082	0.010	0.084	0.151	0.329
		Avg	0.024	0.124	0.139	0.319	0.016	0.102	0.035	0.142	0.010	0.085	0.304	0.500	0.010	0.084	0.011	0.086	0.120	0.295

Table 11: Detailed forecasting results on Health, Security, and Traffic under textual perturbation ratio $\rho = 0.3$. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Health	Uni-modal	12	1.512	0.919	1.166	0.722	1.487	0.824	1.131	0.787	1.244	0.749	1.250	0.765	1.061	0.626	0.962	0.624	1.358	0.803
		24	1.875	1.025	1.404	0.785	1.636	0.866	1.549	0.964	1.525	0.832	1.642	0.819	1.811	0.784	1.578	0.758	1.393	0.761
		36	1.971	1.040	1.452	0.801	1.673	0.885	1.622	0.982	1.692	0.891	1.534	0.824	2.187	0.885	1.908	0.857	1.555	0.793
		48	1.881	0.987	1.493	0.814	1.717	0.906	1.647	0.980	1.790	0.931	1.662	0.865	2.240	0.928	2.131	0.911	1.533	0.835
		Avg	1.810	0.993	1.379	0.781	1.628	0.870	1.487	0.928	1.563	0.851	1.522	0.818	1.825	0.806	1.645	0.788	1.460	0.798
	MM-TSFLib	12	1.533	0.921	1.146	0.734	1.412	0.807	1.154	0.792	1.185	0.729	1.146	0.731	1.010	0.625	0.879	0.602	1.199	0.769
		24	1.742	0.960	1.384	0.775	1.535	0.825	1.456	0.919	1.453	0.813	1.391	0.769	1.622	0.767	1.368	0.725	1.271	0.705
		36	1.744	0.955	1.362	0.757	1.578	0.852	1.477	0.911	1.560	0.844	1.447	0.789	1.889	0.847	1.655	0.807	1.339	0.761
		48	1.809	0.957	1.480	0.800	1.630	0.876	1.506	0.911	1.654	0.885	1.554	0.822	1.954	0.889	1.859	0.874	1.425	0.785
		Avg	1.707	0.948	1.343	0.767	1.539	0.840	1.398	0.883	1.463	0.818	1.385	0.778	1.619	0.782	1.440	0.752	1.309	0.755
	TaTS	12	1.320	0.832	0.942	0.648	1.282	0.765	1.113	0.768	1.123	0.711	0.973	0.668	0.911	0.616	0.795	0.594	0.944	0.651
		24	1.556	0.911	1.217	0.737	1.399	0.790	1.362	0.858	1.362	0.786	1.183	0.725	1.314	0.720	1.198	0.707	1.126	0.709
		36	1.564	0.899	1.321	0.744	1.449	0.809	1.423	0.867	1.421	0.801	1.210	0.733	1.597	0.810	1.453	0.777	1.190	0.717
		48	1.603	0.896	1.354	0.763	1.504	0.834	1.476	0.889	1.495	0.837	1.305	0.778	1.701	0.850	1.592	0.822	1.294	0.751
		Avg	1.511	0.885	1.209	0.723	1.409	0.800	1.344	0.845	1.350	0.784	1.168	0.726	1.381	0.749	1.260	0.725	1.139	0.707
	PA-RNet	12	1.349	0.847	0.929	0.651	1.287	0.766	1.060	0.743	1.125	0.712	0.957	0.669	0.891	0.615	0.783	0.592	0.971	0.668
		24	1.482	0.877	1.191	0.722	1.398	0.789	1.358	0.854	1.344	0.775	1.144	0.704	1.254	0.708	1.149	0.693	1.148	0.705
		36	1.577	0.901	1.289	0.737	1.442	0.810	1.414	0.863	1.420	0.801	1.221	0.733	1.593	0.822	1.446	0.777	1.180	0.710
		48	1.524	0.877	1.385	0.774	1.509	0.830	1.461	0.880	1.499	0.838	1.312	0.772	1.675	0.850	1.619	0.827	1.274	0.741
		Avg	1.483	0.876	1.199	0.721	1.409	0.799	1.323	0.835	1.347	0.782	1.159	0.720	1.353	0.749	1.249	0.722	1.143	0.706
Social Good	Uni-modal	6	1.026	0.557	0.765	0.428	0.928	0.519	0.945	0.464	0.885	0.424	0.759	0.388	1.083	0.562	0.914	0.474	0.732	0.392
		8	1.095	0.585	0.833	0.455	1.018	0.562	1.170	0.510	1.080	0.497	0.791	0.412	1.155	0.568	1.046	0.526	0.814	0.422
		10	1.144	0.596	0.892	0.500	1.057	0.585	1.251	0.546	1.208	0.576	0.827	0.426	1.171	0.603	1.094	0.526	0.830	0.445
		12	1.247	0.634	0.926	0.501	1.159	0.629	1.352	0.589	1.300	0.600	0.845	0.461	1.248	0.637	1.152	0.541	0.898	0.449
		Avg	1.128	0.593	0.854	0.471	1.041	0.574	1.180	0.527	1.118	0.524	0.805	0.422	1.164	0.593	1.052	0.517	0.819	0.427
	MM-TSFLib	6	0.987	0.555	0.754	0.429	0.938	0.532	0.921	0.474	0.871	0.466	0.737	0.380	0.914	0.452	0.902	0.500	0.771	0.398
		8	1.028	0.563	0.838	0.476	0.991	0.559	1.110	0.518	1.011	0.522	0.788	0.419	1.007	0.542	0.992	0.528	0.826	0.425
		10	1.104	0.597	0.874	0.489	1.047	0.591	1.194	0.570	1.101	0.559	0.831	0.449	1.070	0.520	0.998	0.499	0.863	0.443
		12	1.218	0.677	0.916	0.517	1.113	0.628	1.281	0.600	1.164	0.587	0.836	0.461	1.165	0.587	1.095	0.554	0.867	0.464
		Avg	1.084	0.598	0.846	0.478	1.022	0.578	1.127	0.541	1.037	0.534	0.798	0.427	1.039	0.525	0.997	0.520	0.832	0.433
	TaTS	6	1.010	0.574	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.762	0.382	1.043	0.638	0.969	0.532	0.777	0.399
		8	1.056	0.598	0.817	0.461	1.030	0.575	1.056	0.557	1.013	0.509	0.819	0.412	1.069	0.640	0.929	0.468	0.841	0.423
		10	1.108	0.630	0.884	0.496	1.044	0.585	1.131	0.603	1.108	0.556	0.875	0.459	1.155	0.682	1.057	0.531	0.856	0.429
		12	1.167	0.653	0.923	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.856	0.452	1.190	0.705	1.221	0.546	0.854	0.456
		Avg	1.085	0.614	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.828	0.426	1.114	0.666	1.044	0.519	0.832	0.427
	PA-RNet	6	0.976	0.531	0.756	0.419	0.917	0.522	0.896	0.486	0.854	0.429	0.724	0.386	1.121	0.621	0.970	0.523	0.761	0.391
		8	1.067	0.612	0.824	0.447	1.004	0.563	1.157	0.554	0.998	0.497	0.797	0.407	1.139	0.595	0.995	0.473	0.779	0.411
		10	1.113	0.612	0.898	0.498	1.034	0.578	1.083	0.579	1.104	0.551	0.828	0.414	1.171	0.580	1.072	0.496	0.825	0.434
		12	1.162	0.640	0.894	0.482	1.109	0.612	1.207	0.611	1.176	0.581	0.859	0.463	1.154	0.598	1.128	0.536	0.906	0.469
		Avg	1.080	0.599	0.843	0.461	1.016	0.569	1.086	0.558	1.033	0.515	0.802	0.418	1.146	0.598	1.041	0.507	0.818	0.426
Traffic	Uni-modal	6	0.178	0.265	0.190	0.320	0.342	0.458	0.186	0.265	0.261	0.365	0.145	0.280	0.168	0.233	0.168	0.233	0.153	0.268
		8	0.160	0.243	0.193	0.322	0.316	0.434	0.185	0.264	0.241	0.318	0.159	0.302	0.181	0.235	0.178	0.237	0.150	0.265
		10	0.196	0.288	0.195	0.313	0.305	0.421	0.186	0.263	0.237	0.307	0.152	0.279	0.186	0.237	0.187	0.238	0.156	0.275
		12	0.243	0.297	0.224	0.318	0.337	0.438	0.256	0.304	0.276	0.328	0.198	0.320	0.243	0.263	0.239	0.259	0.192	0.282
		Avg	0.194	0.273	0.201	0.318	0.325	0.438	0.203	0.274	0.254	0.330	0.163	0.295	0.194	0.242	0.193	0.242	0.163	0.273
	MM-TSFLib	6	0.156	0.242	0.180	0.306	0.251	0.381	0.167	0.247	0.239	0.336	0.159	0.299	0.159	0.230	0.160	0.231	0.149	0.260
		8	0.163	0.249	0.189	0.317	0.245	0.368	0.168	0.242	0.224	0.308	0.160	0.297	0.172	0.232	0.170	0.235	0.157	0.275
		10	0.175	0.267	0.189	0.309	0.223	0.350	0.178	0.252	0.222	0.299	0.165	0.302	0.181	0.240	0.180	0.240	0.158	0.274
		12	0.234	0.295	0.218	0.314	0.253	0.362	0.240	0.291	0.264	0.320	0.199	0.313	0.240	0.270	0.239	0.273	0.196	0.283
		Avg	0.182	0.263	0.194	0.312	0.243	0.365	0.188	0.258	0.237	0.316	0.171	0.303	0.188	0.243	0.187	0.245	0.165	0.273
	TaTS	6	0.142	0.209	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.137	0.251	0.159	0.210	0.149	0.206	0.138	0.244
		8	0.146	0.215	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.143	0.267	0.169	0.215	0.161	0.211	0.142	0.254
		10	0.151	0.216	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.146	0.270	0.174	0.220	0.169	0.217	0.144	0.255
		12	0.210	0.251	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.182	0.296	0.230	0.246	0.226	0.242	0.180	0.270
		Avg	0.162	0.223	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.152	0.271	0.183	0.223	0.176	0.219	0.151	0.256
	PA-RNet	6	0.145	0.215	0.156	0.276	0.190	0.311	0.150	0.210	0.171	0.272	0.144	0.262	0.150	0.206	0.148	0.205	0.145	0.247
		8	0.147	0.209	0.161	0.280	0.187	0.306	0.154	0.217	0.172	0.248	0.144	0.259	0.165	0.215	0.160	0.213	0.150	0.256
		10	0.153	0.222	0.164	0.284	0.189	0.310	0.163	0.231	0.173	0.246	0.155	0.282	0.168	0.216	0.168	0.215	0.152	0.254
		12	0.208	0.249	0.194	0.290	0.217	0.313	0.218	0.263	0.217	0.261	0.182	0.271	0.228	0.245	0.225	0.242	0.187	0.263
		Avg	0.163	0.224	0.169	0.283	0.196	0.310	0.171	0.230	0.183	0.257	0.156	0.268	0.178	0.221	0.175	0.219	0.158	0.255

Table 12: Detailed forecasting results on Agriculture, Climate, and Economy under textual perturbation ratio $\rho = 0.5$. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Uni-modal	6	0.078	0.205	0.173	0.303	0.156	0.302	0.074	0.195	0.066	0.160	0.272	0.384	0.067	0.180	0.059	0.160	0.199	0.315
		8	0.091	0.217	0.266	0.373	0.173	0.320	0.090	0.219	0.084	0.183	0.315	0.403	0.079	0.188	0.079	0.183	0.208	0.311
		10	0.110	0.248	0.362	0.450	0.206	0.343	0.105	0.247	0.108	0.209	0.490	0.530	0.102	0.219	0.101	0.206	0.305	0.390
		12	0.134	0.269	0.436	0.495	0.247	0.371	0.132	0.273	0.142	0.241	0.578	0.567	0.134	0.247	0.131	0.238	0.419	0.451
		Avg	0.103	0.235	0.309	0.405	0.195	0.334	0.100	0.234	0.100	0.198	0.414	0.471	0.096	0.209	0.093	0.197	0.283	0.367
	MM-TSFLib	6	0.076	0.198	0.143	0.267	0.093	0.203	0.073	0.194	0.067	0.161	0.202	0.319	0.072	0.202	0.061	0.163	0.158	0.276
		8	0.093	0.223	0.241	0.355	0.136	0.265	0.091	0.219	0.085	0.184	0.261	0.367	0.092	0.220	0.078	0.182	0.221	0.328
		10	0.108	0.249	0.272	0.372	0.154	0.273	0.108	0.247	0.110	0.211	0.379	0.450	0.111	0.246	0.098	0.204	0.256	0.350
		12	0.133	0.273	0.335	0.407	0.193	0.296	0.134	0.268	0.139	0.236	0.515	0.534	0.136	0.262	0.131	0.235	0.304	0.376
		Avg	0.103	0.236	0.248	0.350	0.144	0.259	0.101	0.232	0.100	0.198	0.339	0.418	0.103	0.233	0.092	0.196	0.235	0.333
	TaTS	6	0.077	0.196	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.120	0.257	0.064	0.174	0.060	0.161	0.096	0.249
		8	0.095	0.221	0.155	0.275	0.133	0.264	0.089	0.222	0.083	0.181	0.163	0.289	0.080	0.190	0.078	0.181	0.124	0.265
		10	0.109	0.250	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.232	0.328	0.101	0.212	0.100	0.204	0.177	0.290
		12	0.139	0.274	0.255	0.339	0.194	0.308	0.131	0.272	0.139	0.236	0.343	0.406	0.130	0.240	0.131	0.235	0.233	0.322
		Avg	0.105	0.235	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.215	0.320	0.094	0.204	0.092	0.195	0.158	0.282
	PA-RNet	6	0.074	0.196	0.093	0.220	0.118	0.249	0.074	0.191	0.065	0.159	0.119	0.257	0.064	0.177	0.060	0.161	0.099	0.244
		8	0.093	0.216	0.146	0.261	0.135	0.264	0.087	0.214	0.084	0.182	0.169	0.289	0.081	0.193	0.077	0.181	0.122	0.262
		10	0.107	0.243	0.197	0.293	0.158	0.283	0.107	0.239	0.108	0.208	0.237	0.332	0.101	0.212	0.099	0.203	0.175	0.296
		12	0.137	0.274	0.252	0.329	0.190	0.307	0.131	0.267	0.139	0.235	0.334	0.400	0.131	0.247	0.129	0.236	0.237	0.322
		Avg	0.103	0.232	0.172	0.276	0.150	0.276	0.100	0.228	0.099	0.196	0.215	0.320	0.094	0.207	0.091	0.195	0.158	0.281
Climate	Uni-modal	6	1.315	0.930	1.151	0.844	1.309	0.929	1.093	0.834	1.337	0.940	1.118	0.821	1.160	0.892	1.285	0.925	1.058	0.798
		8	1.296	0.924	1.153	0.846	1.270	0.918	1.136	0.849	1.380	0.967	1.158	0.845	1.206	0.901	1.300	0.933	1.058	0.799
		10	1.280	0.919	1.149	0.850	1.295	0.928	1.199	0.891	1.387	0.972	1.193	0.866	1.233	0.909	1.306	0.939	1.091	0.829
		12	1.264	0.904	1.205	0.875	1.258	0.909	1.176	0.882	1.369	0.965	1.202	0.866	1.196	0.897	1.292	0.933	1.041	0.803
		Avg	1.289	0.919	1.165	0.854	1.283	0.921	1.151	0.864	1.368	0.961	1.168	0.850	1.199	0.900	1.296	0.933	1.062	0.807
	MM-TSFLib	6	1.152	0.872	1.160	0.838	1.110	0.856	0.990	0.798	1.181	0.882	1.147	0.839	1.056	0.848	1.132	0.871	1.038	0.790
		8	1.126	0.857	1.110	0.828	1.099	0.851	1.031	0.815	1.190	0.896	1.095	0.822	1.136	0.873	1.148	0.871	1.046	0.798
		10	1.143	0.862	1.110	0.833	1.098	0.848	1.063	0.832	1.205	0.902	1.072	0.812	1.110	0.859	1.176	0.880	1.050	0.803
		12	1.143	0.871	1.111	0.838	1.100	0.844	1.069	0.831	1.189	0.897	1.088	0.823	1.113	0.862	1.158	0.877	1.040	0.803
		Avg	1.141	0.866	1.123	0.834	1.102	0.850	1.038	0.819	1.191	0.894	1.101	0.824	1.104	0.861	1.153	0.875	1.044	0.799
	TaTS	6	1.009	0.814	1.027	0.778	0.929	0.771	0.909	0.764	0.969	0.784	1.026	0.787	0.990	0.800	0.974	0.793	0.914	0.740
		8	1.014	0.813	1.020	0.782	0.942	0.776	0.939	0.775	0.974	0.793	0.980	0.773	1.019	0.806	0.986	0.788	0.933	0.748
		10	1.000	0.805	1.029	0.790	0.963	0.783	0.995	0.799	0.997	0.803	0.991	0.781	1.021	0.808	1.023	0.808	0.998	0.778
		12	0.990	0.801	1.054	0.804	0.967	0.781	0.992	0.810	1.002	0.806	1.031	0.795	1.049	0.823	1.021	0.809	0.978	0.777
		Avg	1.003	0.808	1.033	0.789	0.950	0.778	0.959	0.787	0.986	0.797	1.007	0.784	1.020	0.809	1.001	0.800	0.956	0.761
	PA-RNet	6	1.021	0.822	0.994	0.772	0.924	0.768	0.919	0.765	0.971	0.784	0.972	0.778	0.994	0.796	0.950	0.780	0.916	0.736
		8	0.942	0.785	1.031	0.785	0.940	0.774	0.938	0.776	0.970	0.791	0.971	0.774	0.992	0.794	0.973	0.785	0.953	0.757
		10	0.961	0.792	1.016	0.785	0.960	0.782	0.987	0.804	0.992	0.801	0.958	0.766	1.027	0.811	1.015	0.806	0.996	0.781
		12	0.978	0.796	1.017	0.787	0.968	0.782	0.984	0.797	1.001	0.805	0.979	0.776	1.042	0.820	1.029	0.812	1.010	0.791
		Avg	0.976	0.799	1.015	0.782	0.948	0.777	0.957	0.786	0.983	0.795	0.970	0.774	1.014	0.805	0.992	0.796	0.969	0.766
Economy	Uni-modal	6	0.085	0.234	0.265	0.440	0.094	0.257	0.096	0.234	0.017	0.103	0.496	0.665	0.016	0.098	0.020	0.108	0.207	0.351
		8	0.097	0.247	0.344	0.531	0.101	0.271	0.072	0.210	0.018	0.109	0.580	0.722	0.016	0.098	0.019	0.109	0.119	0.268
		10	0.075	0.213	0.817	0.776	0.116	0.288	0.064	0.199	0.018	0.109	0.530	0.687	0.016	0.098	0.018	0.105	0.121	0.270
		12	0.074	0.216	0.837	0.821	0.141	0.309	0.077	0.221	0.018	0.110	0.680	0.776	0.016	0.099	0.018	0.105	0.071	0.216
		Avg	0.083	0.227	0.566	0.642	0.113	0.281	0.077	0.216	0.018	0.108	0.572	0.712	0.016	0.098	0.019	0.107	0.129	0.276
	MM-TSFLib	6	0.095	0.241	0.396	0.498	0.047	0.174	0.081	0.220	0.017	0.104	0.410	0.593	0.016	0.096	0.020	0.109	0.142	0.299
		8	0.090	0.234	0.231	0.407	0.055	0.184	0.070	0.205	0.018	0.109	0.436	0.621	0.016	0.096	0.019	0.108	0.166	0.326
		10	0.080	0.220	0.614	0.636	0.048	0.172	0.061	0.195	0.018	0.108	0.532	0.687	0.016	0.100	0.018	0.105	0.169	0.339
		12	0.079	0.212	0.485	0.643	0.056	0.178	0.069	0.208	0.018	0.110	0.541	0.691	0.016	0.098	0.018	0.107	0.181	0.362
		Avg	0.086	0.227	0.432	0.546	0.052	0.177	0.070	0.207	0.018	0.108	0.480	0.648	0.016	0.098	0.019	0.107	0.164	0.332
	TaTS	6	0.028	0.134	0.101	0.272	0.017	0.106	0.040	0.153	0.011	0.087	0.201	0.406	0.011	0.085	0.011	0.086	0.064	0.208
		8	0.030	0.139	0.131	0.315	0.016	0.103	0.037	0.145	0.010	0.085	0.295	0.496	0.011	0.085	0.011	0.087	0.100	0.267
		10	0.024	0.121	0.191	0.379	0.015	0.099	0.030	0.132	0.010	0.084	0.347	0.558	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.023	0.121	0.221	0.418	0.015	0.099	0.038	0.150	0.010	0.083	0.386	0.586	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.026	0.129	0.161	0.346	0.016	0.102	0.036	0.145	0.010	0.085	0.307	0.512	0.011	0.085	0.011	0.086	0.133	0.311
	PA-RNet	6	0.024	0.122	0.078	0.237	0.018	0.108	0.036	0.144	0.011	0.086	0.164	0.362	0.011	0.085	0.011	0.087	0.067	0.213
		8	0.026	0.129	0.153	0.351	0.016	0.103	0.035	0.142	0.010	0.085	0.260	0.468	0.010	0.085	0.011	0.087	0.099	0.264
		10	0.024	0.125	0.171	0.366	0.015	0.099	0.032	0.134	0.010	0.084	0.346	0.549	0.010	0.084	0.010	0.085	0.113	0.279
		12	0.020	0.112	0.212	0.414	0.015	0.099	0.038	0.146	0.010	0.083	0.437	0.620	0.010	0.082	0.010	0.084	0.245	0.447
		Avg	0.024	0.122	0.154	0.342	0.016	0.102	0.035	0.142	0.010	0.085	0.302	0.500	0.010	0.084	0.011	0.086	0.131	0.301

Table 13: Detailed forecasting results on Health, Security, and Traffic under textual perturbation ratio $\rho = 0.5$. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Health	Uni-modal	12	1.512	0.919	1.216	0.748	1.579	0.855	1.131	0.787	1.244	0.749	1.250	0.765	1.061	0.626	0.962	0.624	1.358	0.803
		24	1.875	1.025	1.434	0.798	1.656	0.879	1.549	0.964	1.525	0.832	1.642	0.819	1.811	0.784	1.578	0.758	1.393	0.761
		36	1.971	1.040	1.450	0.781	1.692	0.892	1.622	0.982	1.692	0.891	1.534	0.824	2.187	0.885	1.908	0.857	1.555	0.793
		48	1.881	0.987	1.591	0.834	1.731	0.913	1.647	0.980	1.790	0.931	1.662	0.865	2.240	0.928	2.131	0.911	1.533	0.835
		Avg	1.810	0.993	1.423	0.790	1.664	0.885	1.487	0.928	1.563	0.851	1.522	0.818	1.825	0.806	1.645	0.788	1.460	0.798
	MM-TSFLib	12	1.449	0.885	1.061	0.685	1.408	0.804	1.190	0.805	1.186	0.734	1.120	0.727	0.999	0.624	0.879	0.603	1.171	0.762
		24	1.872	1.014	1.371	0.778	1.534	0.824	1.445	0.908	1.452	0.813	1.406	0.773	1.622	0.767	1.353	0.721	1.280	0.709
		36	1.806	0.971	1.359	0.754	1.580	0.852	1.479	0.912	1.562	0.845	1.462	0.787	1.892	0.847	1.662	0.809	1.340	0.754
		48	1.864	0.975	1.500	0.800	1.630	0.878	1.503	0.907	1.653	0.885	1.562	0.823	1.945	0.892	1.863	0.874	1.446	0.789
		Avg	1.748	0.961	1.323	0.754	1.538	0.840	1.404	0.883	1.463	0.819	1.388	0.778	1.615	0.783	1.439	0.752	1.309	0.754
	TaTS	12	1.348	0.867	0.992	0.677	1.282	0.765	1.119	0.765	1.123	0.711	1.018	0.686	0.886	0.606	0.795	0.594	0.943	0.650
		24	1.456	0.877	1.278	0.758	1.399	0.790	1.375	0.862	1.362	0.786	1.182	0.725	1.316	0.724	1.198	0.707	1.125	0.709
		36	1.544	0.895	1.262	0.735	1.449	0.809	1.423	0.867	1.421	0.801	1.212	0.734	1.604	0.813	1.453	0.777	1.190	0.717
		48	1.574	0.886	1.347	0.762	1.504	0.834	1.475	0.889	1.495	0.837	1.305	0.778	1.704	0.852	1.592	0.822	1.294	0.751
		Avg	1.481	0.881	1.220	0.733	1.409	0.800	1.348	0.846	1.350	0.784	1.179	0.731	1.378	0.749	1.260	0.725	1.138	0.707
	PA-RNet	12	1.275	0.820	0.945	0.657	1.287	0.766	1.160	0.789	1.125	0.712	0.954	0.667	0.916	0.617	0.783	0.592	0.933	0.650
		24	1.508	0.888	1.292	0.766	1.398	0.789	1.371	0.859	1.344	0.775	1.137	0.702	1.276	0.714	1.149	0.693	1.174	0.712
		36	1.532	0.891	1.256	0.734	1.442	0.810	1.414	0.863	1.420	0.801	1.221	0.733	1.572	0.814	1.446	0.777	1.178	0.715
		48	1.570	0.890	1.354	0.766	1.509	0.830	1.461	0.880	1.499	0.838	1.307	0.773	1.666	0.846	1.619	0.827	1.289	0.746
		Avg	1.471	0.872	1.212	0.731	1.409	0.799	1.352	0.848	1.347	0.782	1.155	0.719	1.358	0.748	1.249	0.722	1.144	0.706
Social Good	Uni-modal	6	1.026	0.557	0.765	0.428	0.928	0.519	0.945	0.464	0.885	0.424	0.759	0.388	1.083	0.562	0.914	0.474	0.732	0.392
		8	1.095	0.585	0.833	0.455	1.018	0.562	1.170	0.510	1.080	0.497	0.791	0.412	1.155	0.568	1.046	0.526	0.814	0.422
		10	1.144	0.596	0.892	0.500	1.057	0.585	1.251	0.546	1.208	0.576	0.827	0.426	1.171	0.603	1.094	0.526	0.830	0.445
		12	1.247	0.634	0.926	0.501	1.159	0.629	1.352	0.589	1.300	0.600	0.845	0.461	1.248	0.637	1.152	0.541	0.898	0.449
		Avg	1.128	0.593	0.854	0.471	1.041	0.574	1.180	0.527	1.118	0.524	0.805	0.422	1.164	0.593	1.052	0.517	0.819	0.427
	MM-TSFLib	6	0.981	0.549	0.754	0.428	0.946	0.536	0.917	0.474	0.873	0.467	0.762	0.399	0.998	0.505	0.973	0.537	0.777	0.406
		8	1.040	0.581	0.837	0.477	0.985	0.560	1.111	0.518	1.015	0.526	0.784	0.421	0.998	0.518	1.013	0.547	0.812	0.419
		10	1.113	0.603	0.874	0.488	1.049	0.591	1.196	0.572	1.102	0.559	0.830	0.444	1.017	0.515	1.007	0.512	0.849	0.445
		12	1.208	0.676	0.914	0.514	1.111	0.626	1.292	0.603	1.162	0.586	0.842	0.460	1.138	0.598	1.097	0.554	0.869	0.468
		Avg	1.086	0.602	0.845	0.477	1.023	0.578	1.129	0.542	1.038	0.535	0.805	0.431	1.038	0.534	1.023	0.538	0.827	0.435
	TaTS	6	1.005	0.564	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.759	0.383	1.047	0.654	0.969	0.532	0.777	0.399
		8	1.049	0.596	0.817	0.461	1.030	0.575	1.056	0.557	1.013	0.509	0.819	0.415	1.110	0.661	0.929	0.468	0.833	0.422
		10	1.093	0.610	0.884	0.496	1.044	0.585	1.131	0.603	1.108	0.556	0.880	0.445	1.151	0.685	1.057	0.531	0.856	0.429
		12	1.167	0.655	0.923	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.855	0.441	1.191	0.706	1.221	0.546	0.855	0.456
		Avg	1.079	0.606	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.828	0.421	1.125	0.677	1.044	0.519	0.830	0.427
	PA-RNet	6	0.974	0.536	0.756	0.419	0.917	0.522	0.900	0.493	0.854	0.429	0.726	0.391	1.092	0.610	0.970	0.523	0.773	0.397
		8	1.073	0.618	0.823	0.447	1.004	0.563	1.050	0.547	0.998	0.497	0.793	0.399	1.122	0.589	0.995	0.473	0.776	0.405
		10	1.103	0.609	0.895	0.497	1.034	0.578	1.058	0.558	1.104	0.551	0.817	0.412	1.266	0.607	1.072	0.496	0.818	0.437
		12	1.166	0.641	0.893	0.482	1.109	0.612	1.155	0.612	1.176	0.581	0.852	0.462	1.122	0.586	1.128	0.536	0.893	0.472
		Avg	1.079	0.601	0.842	0.461	1.016	0.569	1.041	0.553	1.033	0.515	0.797	0.416	1.151	0.598	1.041	0.507	0.815	0.428
Traffic	Uni-modal	6	0.178	0.265	0.190	0.320	0.342	0.458	0.186	0.265	0.261	0.365	0.145	0.280	0.168	0.233	0.168	0.233	0.153	0.268
		8	0.160	0.243	0.193	0.322	0.316	0.434	0.185	0.264	0.241	0.318	0.159	0.302	0.181	0.235	0.178	0.237	0.150	0.265
		10	0.196	0.288	0.195	0.313	0.305	0.421	0.186	0.263	0.237	0.307	0.152	0.279	0.186	0.237	0.187	0.238	0.156	0.275
		12	0.243	0.297	0.224	0.318	0.337	0.438	0.256	0.304	0.276	0.328	0.198	0.320	0.243	0.263	0.239	0.259	0.192	0.282
		Avg	0.194	0.273	0.201	0.318	0.325	0.438	0.203	0.274	0.254	0.330	0.163	0.295	0.194	0.242	0.193	0.242	0.163	0.273
	MM-TSFLib	6	0.159	0.245	0.181	0.308	0.251	0.381	0.165	0.245	0.237	0.332	0.163	0.306	0.158	0.229	0.160	0.231	0.149	0.260
		8	0.159	0.241	0.188	0.314	0.246	0.369	0.169	0.244	0.218	0.298	0.165	0.307	0.173	0.233	0.169	0.235	0.157	0.274
		10	0.176	0.267	0.189	0.308	0.224	0.351	0.175	0.250	0.223	0.304	0.160	0.296	0.179	0.238	0.180	0.240	0.155	0.270
		12	0.233	0.293	0.218	0.314	0.251	0.360	0.241	0.293	0.267	0.326	0.200	0.315	0.235	0.266	0.239	0.273	0.196	0.284
		Avg	0.182	0.262	0.194	0.311	0.243	0.365	0.188	0.258	0.236	0.315	0.172	0.306	0.186	0.242	0.187	0.245	0.164	0.272
	TaTS	6	0.149	0.219	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.137	0.248	0.157	0.209	0.149	0.206	0.138	0.244
		8	0.149	0.215	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.143	0.266	0.169	0.215	0.161	0.211	0.142	0.254
		10	0.155	0.223	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.145	0.267	0.172	0.218	0.169	0.217	0.144	0.255
		12	0.214	0.256	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.182	0.296	0.230	0.246	0.226	0.242	0.180	0.270
		Avg	0.167	0.228	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.152	0.269	0.182	0.222	0.176	0.219	0.151	0.256
	PA-RNet	6	0.145	0.213	0.156	0.276	0.190	0.311	0.152	0.214	0.171	0.272	0.139	0.251	0.151	0.206	0.148	0.205	0.140	0.242
		8	0.146	0.214	0.161	0.280	0.187	0.306	0.156	0.218	0.172	0.248	0.140	0.250	0.164	0.214	0.160	0.213	0.142	0.247
		10	0.151	0.221	0.164	0.284	0.189	0.310	0.165	0.233	0.173	0.246	0.156	0.291	0.169	0.215	0.168	0.215	0.146	0.249
		12	0.208	0.250	0.194	0.290	0.217	0.313	0.216	0.262	0.217	0.261	0.177	0.267	0.227	0.245	0.225	0.242	0.183	0.260
		Avg	0.162	0.225	0.169	0.283	0.196	0.310	0.172	0.232	0.183	0.257	0.153	0.265	0.178	0.220	0.175	0.219	0.153	0.250

Table 14: Detailed forecasting results on Agriculture, Climate, and Economy under textual perturbation ratio $\rho = 0.7$. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Uni-modal	6	0.078	0.205	0.173	0.303	0.156	0.302	0.074	0.195	0.066	0.160	0.272	0.384	0.067	0.180	0.059	0.160	0.199	0.315
		8	0.091	0.217	0.266	0.373	0.173	0.320	0.090	0.219	0.084	0.183	0.315	0.403	0.079	0.188	0.079	0.183	0.208	0.311
		10	0.110	0.248	0.362	0.450	0.206	0.343	0.105	0.247	0.108	0.209	0.490	0.530	0.102	0.219	0.101	0.206	0.305	0.390
		12	0.134	0.269	0.436	0.495	0.247	0.371	0.132	0.273	0.142	0.241	0.578	0.567	0.134	0.247	0.131	0.238	0.419	0.451
		Avg	0.103	0.235	0.309	0.405	0.195	0.334	0.100	0.234	0.100	0.198	0.414	0.471	0.096	0.209	0.093	0.197	0.283	0.367
	MM-TSFLib	6	0.076	0.198	0.138	0.259	0.103	0.227	0.073	0.194	0.067	0.161	0.205	0.322	0.071	0.198	0.061	0.163	0.159	0.277
		8	0.093	0.223	0.241	0.354	0.133	0.257	0.091	0.219	0.085	0.184	0.264	0.368	0.092	0.221	0.078	0.182	0.218	0.330
		10	0.108	0.249	0.269	0.369	0.154	0.273	0.108	0.247	0.110	0.211	0.378	0.449	0.111	0.244	0.098	0.204	0.254	0.348
		12	0.133	0.273	0.337	0.409	0.193	0.296	0.134	0.268	0.139	0.236	0.525	0.542	0.136	0.262	0.131	0.235	0.301	0.373
		Avg	0.103	0.236	0.246	0.348	0.146	0.263	0.101	0.232	0.100	0.198	0.343	0.420	0.103	0.231	0.092	0.196	0.233	0.332
	TaTS	6	0.072	0.188	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.121	0.256	0.064	0.176	0.060	0.161	0.096	0.249
		8	0.094	0.224	0.155	0.275	0.133	0.264	0.089	0.222	0.083	0.181	0.165	0.290	0.080	0.193	0.078	0.181	0.125	0.267
		10	0.110	0.250	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.230	0.327	0.101	0.213	0.100	0.204	0.176	0.288
		12	0.138	0.276	0.255	0.339	0.194	0.308	0.131	0.272	0.139	0.236	0.343	0.407	0.131	0.241	0.131	0.235	0.233	0.322
		Avg	0.104	0.235	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.215	0.320	0.094	0.206	0.092	0.195	0.158	0.282
	PA-RNet	6	0.075	0.196	0.093	0.220	0.118	0.249	0.074	0.191	0.065	0.159	0.114	0.250	0.064	0.177	0.060	0.161	0.096	0.238
		8	0.094	0.224	0.146	0.261	0.135	0.264	0.088	0.215	0.084	0.182	0.168	0.292	0.081	0.193	0.077	0.181	0.124	0.260
		10	0.107	0.247	0.196	0.293	0.158	0.283	0.107	0.239	0.108	0.208	0.236	0.330	0.101	0.212	0.099	0.203	0.165	0.289
		12	0.138	0.270	0.252	0.329	0.190	0.307	0.131	0.267	0.139	0.235	0.315	0.384	0.131	0.246	0.129	0.236	0.237	0.324
		Avg	0.104	0.234	0.172	0.276	0.150	0.276	0.100	0.228	0.099	0.196	0.208	0.314	0.094	0.207	0.091	0.195	0.156	0.278
Climate	Uni-modal	6	1.315	0.930	1.151	0.844	1.309	0.929	1.093	0.834	1.337	0.940	1.118	0.821	1.160	0.892	1.285	0.925	1.058	0.798
		8	1.296	0.924	1.153	0.846	1.270	0.918	1.136	0.849	1.380	0.967	1.158	0.845	1.206	0.901	1.300	0.933	1.058	0.799
		10	1.280	0.919	1.149	0.850	1.295	0.928	1.199	0.891	1.387	0.972	1.193	0.866	1.233	0.909	1.306	0.939	1.091	0.829
		12	1.264	0.904	1.205	0.875	1.258	0.909	1.176	0.882	1.369	0.965	1.202	0.866	1.196	0.897	1.292	0.933	1.041	0.803
		Avg	1.289	0.919	1.165	0.854	1.283	0.921	1.151	0.864	1.368	0.961	1.168	0.850	1.199	0.900	1.296	0.933	1.062	0.807
	MM-TSFLib	6	1.129	0.864	1.162	0.839	1.108	0.855	0.991	0.797	1.185	0.883	1.152	0.838	1.059	0.848	1.131	0.870	1.037	0.789
		8	1.131	0.859	1.112	0.829	1.100	0.853	1.030	0.816	1.189	0.896	1.094	0.821	1.139	0.874	1.146	0.871	1.035	0.795
		10	1.145	0.860	1.110	0.833	1.089	0.844	1.062	0.832	1.205	0.902	1.105	0.828	1.109	0.859	1.177	0.881	1.018	0.790
		12	1.124	0.851	1.114	0.839	1.101	0.845	1.073	0.835	1.189	0.897	1.134	0.841	1.114	0.863	1.148	0.873	1.038	0.803
		Avg	1.132	0.858	1.125	0.835	1.100	0.849	1.039	0.820	1.192	0.895	1.121	0.832	1.105	0.861	1.151	0.874	1.032	0.794
	TaTS	6	1.005	0.817	1.027	0.778	0.929	0.771	0.910	0.764	0.969	0.784	1.032	0.788	0.991	0.800	0.974	0.793	0.914	0.740
		8	1.024	0.817	1.020	0.782	0.942	0.776	0.939	0.774	0.974	0.793	0.991	0.781	1.023	0.809	0.986	0.788	0.933	0.748
		10	0.998	0.805	1.029	0.790	0.963	0.783	0.997	0.800	0.997	0.803	1.005	0.783	1.023	0.809	1.023	0.808	0.998	0.778
		12	0.993	0.803	1.054	0.804	0.967	0.781	1.007	0.813	1.002	0.806	1.053	0.804	1.049	0.823	1.021	0.809	0.978	0.777
		Avg	1.005	0.811	1.033	0.789	0.950	0.778	0.963	0.788	0.986	0.797	1.020	0.789	1.022	0.810	1.001	0.800	0.956	0.761
	PA-RNet	6	1.016	0.819	0.994	0.772	0.924	0.768	0.918	0.765	0.971	0.784	0.968	0.772	0.995	0.796	0.950	0.780	0.913	0.736
		8	0.953	0.794	1.031	0.785	0.940	0.774	0.938	0.776	0.970	0.791	0.961	0.767	0.992	0.794	0.973	0.785	0.967	0.764
		10	0.952	0.783	1.016	0.785	0.960	0.782	0.990	0.802	0.992	0.801	0.962	0.767	1.030	0.812	1.015	0.806	0.999	0.782
		12	0.952	0.783	1.017	0.787	0.968	0.782	0.984	0.797	1.001	0.805	0.985	0.779	1.043	0.821	1.029	0.812	1.013	0.792
		Avg	0.968	0.795	1.015	0.782	0.948	0.777	0.958	0.785	0.983	0.795	0.969	0.771	1.015	0.806	0.992	0.796	0.973	0.769
Economy	Uni-modal	6	0.085	0.234	0.265	0.440	0.094	0.257	0.096	0.234	0.017	0.103	0.496	0.665	0.016	0.098	0.020	0.108	0.207	0.351
		8	0.097	0.247	0.344	0.531	0.101	0.271	0.072	0.210	0.018	0.109	0.580	0.722	0.016	0.098	0.019	0.109	0.119	0.268
		10	0.075	0.213	0.817	0.776	0.116	0.288	0.064	0.199	0.018	0.109	0.530	0.687	0.016	0.098	0.018	0.105	0.121	0.270
		12	0.074	0.216	0.837	0.821	0.141	0.309	0.077	0.221	0.018	0.110	0.680	0.776	0.016	0.099	0.018	0.105	0.071	0.216
		Avg	0.083	0.227	0.566	0.642	0.113	0.281	0.077	0.216	0.018	0.108	0.572	0.712	0.016	0.098	0.019	0.107	0.129	0.276
	MM-TSFLib	6	0.094	0.240	0.326	0.450	0.047	0.174	0.081	0.220	0.017	0.104	0.413	0.595	0.016	0.096	0.020	0.109	0.141	0.300
		8	0.082	0.221	0.226	0.410	0.052	0.182	0.070	0.205	0.018	0.109	0.438	0.624	0.016	0.096	0.019	0.108	0.176	0.344
		10	0.077	0.214	0.427	0.603	0.048	0.171	0.061	0.195	0.018	0.108	0.558	0.698	0.016	0.100	0.018	0.105	0.168	0.331
		12	0.080	0.215	0.533	0.684	0.053	0.174	0.069	0.208	0.018	0.110	0.531	0.685	0.016	0.098	0.018	0.107	0.180	0.355
		Avg	0.083	0.222	0.378	0.537	0.050	0.175	0.070	0.207	0.018	0.108	0.485	0.651	0.016	0.098	0.019	0.107	0.166	0.332
	TaTS	6	0.026	0.128	0.102	0.274	0.017	0.106	0.040	0.153	0.011	0.087	0.197	0.404	0.011	0.087	0.011	0.086	0.063	0.208
		8	0.029	0.135	0.111	0.287	0.016	0.103	0.037	0.145	0.010	0.085	0.288	0.488	0.011	0.086	0.011	0.087	0.100	0.267
		10	0.023	0.120	0.214	0.411	0.015	0.099	0.030	0.132	0.010	0.084	0.349	0.558	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.022	0.118	0.233	0.429	0.015	0.099	0.038	0.150	0.010	0.083	0.386	0.586	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.025	0.125	0.165	0.350	0.016	0.102	0.036	0.145	0.010	0.085	0.305	0.509	0.011	0.085	0.011	0.086	0.133	0.311
	PA-RNet	6	0.024	0.126	0.083	0.244	0.018	0.108	0.036	0.144	0.011	0.086	0.149	0.342	0.011	0.085	0.011	0.087	0.080	0.234
		8	0.025	0.125	0.134	0.322	0.016	0.103	0.035	0.142	0.010	0.085	0.246	0.453	0.010	0.085	0.011	0.087	0.139	0.330
		10	0.022	0.119	0.179	0.375	0.015	0.099	0.032	0.134	0.010	0.084	0.343	0.550	0.010	0.084	0.010	0.085	0.198	0.398
		12	0.019	0.111	0.208	0.411	0.015	0.099	0.038	0.146	0.010	0.083	0.449	0.631	0.010	0.082	0.010	0.084	0.215	0.400
		Avg	0.023	0.120	0.151	0.338	0.016	0.102	0.035	0.142	0.010	0.085	0.297	0.494	0.010	0.084	0.011	0.086	0.158	0.341

Table 15: Detailed forecasting results on Health, Security, and Traffic under textual perturbation ratio $\rho = 0.7$. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Health	Uni-modal	12	1.512	0.919	1.166	0.722	1.487	0.824	1.131	0.787	1.244	0.749	1.250	0.765	1.061	0.626	0.962	0.624	1.358	0.803
		24	1.875	1.025	1.404	0.785	1.636	0.866	1.549	0.964	1.525	0.832	1.642	0.819	1.811	0.784	1.578	0.758	1.393	0.761
		36	1.971	1.040	1.452	0.801	1.673	0.885	1.622	0.982	1.692	0.891	1.534	0.824	2.187	0.885	1.908	0.857	1.555	0.793
		48	1.881	0.987	1.493	0.814	1.717	0.906	1.647	0.980	1.790	0.931	1.662	0.865	2.240	0.928	2.131	0.911	1.533	0.835
		Avg	1.810	0.993	1.379	0.781	1.628	0.870	1.487	0.928	1.563	0.851	1.522	0.818	1.825	0.806	1.645	0.788	1.460	0.798
	MM-TSFLib	12	1.485	0.894	1.206	0.753	1.406	0.804	1.155	0.790	1.185	0.729	1.140	0.722	0.990	0.621	0.891	0.608	1.177	0.768
		24	1.746	0.958	1.327	0.758	1.535	0.824	1.442	0.904	1.452	0.813	1.416	0.777	1.622	0.767	1.353	0.723	1.282	0.708
		36	1.824	0.995	1.319	0.742	1.579	0.852	1.466	0.904	1.561	0.845	1.468	0.788	1.884	0.847	1.673	0.815	1.297	0.766
		48	1.797	0.955	1.500	0.806	1.628	0.877	1.503	0.908	1.654	0.885	1.542	0.818	1.947	0.892	1.862	0.875	1.443	0.789
		Avg	1.713	0.951	1.338	0.765	1.537	0.839	1.392	0.877	1.463	0.818	1.392	0.776	1.611	0.782	1.445	0.755	1.300	0.758
	TaTS	12	1.319	0.857	0.999	0.686	1.282	0.765	1.116	0.769	1.123	0.711	0.959	0.664	0.920	0.616	0.795	0.594	0.913	0.641
		24	1.506	0.890	1.226	0.730	1.399	0.790	1.372	0.862	1.362	0.786	1.187	0.725	1.320	0.721	1.198	0.707	1.125	0.709
		36	1.578	0.914	1.277	0.729	1.449	0.809	1.423	0.867	1.421	0.801	1.208	0.732	1.573	0.810	1.453	0.777	1.190	0.717
		48	1.571	0.887	1.356	0.767	1.504	0.834	1.476	0.889	1.495	0.837	1.305	0.778	1.723	0.853	1.592	0.822	1.294	0.751
		Avg	1.494	0.887	1.215	0.728	1.409	0.800	1.347	0.847	1.350	0.784	1.165	0.725	1.384	0.750	1.260	0.725	1.131	0.705
	PA-RNet	12	1.321	0.840	1.008	0.691	1.287	0.766	1.076	0.744	1.125	0.712	0.955	0.670	0.968	0.635	0.783	0.592	0.933	0.654
		24	1.543	0.887	1.176	0.713	1.398	0.789	1.356	0.857	1.344	0.775	1.151	0.708	1.313	0.727	1.149	0.693	1.179	0.714
		36	1.565	0.900	1.289	0.734	1.442	0.810	1.414	0.863	1.420	0.801	1.223	0.736	1.631	0.824	1.446	0.777	1.184	0.714
		48	1.616	0.904	1.354	0.770	1.509	0.830	1.461	0.880	1.499	0.838	1.305	0.774	1.673	0.849	1.619	0.827	1.283	0.746
		Avg	1.511	0.883	1.207	0.727	1.409	0.799	1.327	0.836	1.347	0.782	1.158	0.722	1.396	0.759	1.249	0.722	1.145	0.707
Social Good	Uni-modal	6	1.026	0.557	0.765	0.428	0.928	0.519	0.945	0.464	0.885	0.424	0.759	0.388	1.083	0.562	0.914	0.474	0.732	0.392
		8	1.095	0.585	0.833	0.455	1.018	0.562	1.170	0.510	1.080	0.497	0.791	0.412	1.155	0.568	1.046	0.526	0.814	0.422
		10	1.144	0.596	0.892	0.500	1.057	0.585	1.251	0.546	1.208	0.576	0.827	0.426	1.171	0.603	1.094	0.526	0.830	0.445
		12	1.247	0.634	0.926	0.501	1.159	0.629	1.352	0.589	1.300	0.600	0.845	0.461	1.248	0.637	1.152	0.541	0.898	0.449
		Avg	1.128	0.593	0.854	0.471	1.041	0.574	1.180	0.527	1.118	0.524	0.805	0.422	1.164	0.593	1.052	0.517	0.819	0.427
	MM-TSFLib	6	1.000	0.575	0.755	0.429	0.946	0.536	0.922	0.474	0.877	0.481	0.741	0.380	0.967	0.501	0.905	0.507	0.785	0.407
		8	1.040	0.577	0.837	0.476	0.987	0.560	1.111	0.518	1.013	0.527	0.793	0.420	1.024	0.531	1.000	0.543	0.820	0.421
		10	1.090	0.591	0.875	0.488	1.050	0.592	1.188	0.568	1.101	0.559	0.834	0.441	1.040	0.517	1.022	0.503	0.844	0.449
		12	1.193	0.663	0.914	0.514	1.112	0.626	1.287	0.601	1.163	0.586	0.834	0.450	1.131	0.588	1.107	0.557	0.868	0.466
		Avg	1.081	0.601	0.845	0.477	1.024	0.579	1.127	0.540	1.039	0.538	0.801	0.423	1.041	0.534	1.009	0.528	0.829	0.436
	TaTS	6	0.961	0.533	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.758	0.378	1.049	0.658	0.969	0.532	0.777	0.399
		8	1.060	0.600	0.817	0.461	1.030	0.575	1.056	0.557	1.013	0.509	0.803	0.410	1.084	0.623	0.929	0.468	0.833	0.422
		10	1.086	0.606	0.885	0.496	1.044	0.585	1.131	0.603	1.108	0.556	0.889	0.447	1.216	0.721	1.057	0.531	0.856	0.430
		12	1.158	0.641	0.923	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.851	0.443	1.223	0.701	1.221	0.546	0.851	0.447
		Avg	1.066	0.595	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.825	0.420	1.143	0.676	1.044	0.519	0.829	0.425
	PA-RNet	6	0.979	0.534	0.756	0.419	0.917	0.522	0.904	0.490	0.854	0.429	0.733	0.386	1.209	0.621	0.970	0.523	0.760	0.379
		8	1.070	0.613	0.824	0.447	1.004	0.563	1.059	0.549	0.998	0.497	0.798	0.399	1.121	0.597	0.995	0.473	0.778	0.412
		10	1.104	0.609	0.893	0.494	1.034	0.578	1.074	0.564	1.104	0.551	0.815	0.412	1.279	0.594	1.072	0.496	0.848	0.452
		12	1.176	0.657	0.899	0.480	1.109	0.612	1.209	0.621	1.176	0.581	0.888	0.484	1.186	0.622	1.128	0.536	0.906	0.469
		Avg	1.082	0.603	0.843	0.460	1.016	0.569	1.062	0.556	1.033	0.515	0.809	0.420	1.199	0.608	1.041	0.507	0.823	0.428
Traffic	Uni-modal	6	0.178	0.265	0.190	0.320	0.342	0.458	0.186	0.265	0.261	0.365	0.145	0.280	0.168	0.233	0.168	0.233	0.153	0.268
		8	0.160	0.243	0.193	0.322	0.316	0.434	0.185	0.264	0.241	0.318	0.159	0.302	0.181	0.235	0.178	0.237	0.150	0.265
		10	0.196	0.288	0.195	0.313	0.305	0.421	0.186	0.263	0.237	0.307	0.152	0.279	0.186	0.237	0.187	0.238	0.156	0.275
		12	0.243	0.297	0.224	0.318	0.337	0.438	0.256	0.304	0.276	0.328	0.198	0.320	0.243	0.263	0.239	0.259	0.192	0.282
		Avg	0.194	0.273	0.201	0.318	0.325	0.438	0.203	0.274	0.254	0.330	0.163	0.295	0.194	0.242	0.193	0.242	0.163	0.273
	MM-TSFLib	6	0.165	0.258	0.180	0.307	0.251	0.381	0.165	0.245	0.237	0.335	0.160	0.300	0.157	0.224	0.160	0.230	0.149	0.261
		8	0.162	0.249	0.187	0.317	0.245	0.369	0.169	0.246	0.222	0.305	0.157	0.288	0.173	0.233	0.170	0.236	0.155	0.272
		10	0.173	0.268	0.190	0.310	0.227	0.354	0.178	0.255	0.224	0.305	0.162	0.298	0.179	0.238	0.180	0.241	0.157	0.273
		12	0.239	0.294	0.218	0.314	0.254	0.363	0.242	0.295	0.263	0.316	0.199	0.311	0.235	0.266	0.239	0.273	0.197	0.283
		Avg	0.185	0.267	0.194	0.312	0.244	0.367	0.189	0.260	0.237	0.315	0.169	0.299	0.186	0.240	0.187	0.245	0.164	0.272
	TaTS	6	0.141	0.207	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.138	0.250	0.158	0.210	0.149	0.206	0.138	0.244
		8	0.146	0.214	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.144	0.268	0.169	0.217	0.161	0.211	0.142	0.254
		10	0.152	0.221	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.144	0.266	0.172	0.219	0.169	0.217	0.144	0.255
		12	0.210	0.251	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.181	0.295	0.229	0.246	0.226	0.242	0.180	0.270
		Avg	0.162	0.223	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.152	0.270	0.182	0.223	0.176	0.219	0.151	0.256
	PA-RNet	6	0.144	0.212	0.156	0.276	0.190	0.311	0.147	0.208	0.171	0.272	0.142	0.260	0.150	0.207	0.148	0.205	0.139	0.235
		8	0.148	0.215	0.161	0.280	0.187	0.306	0.152	0.213	0.172	0.248	0.139	0.247	0.164	0.214	0.160	0.213	0.143	0.239
		10	0.151	0.222	0.164	0.283	0.189	0.310	0.161	0.229	0.173	0.246	0.158	0.290	0.168	0.216	0.168	0.215	0.146	0.241
		12	0.209	0.250	0.194	0.290	0.217	0.313	0.215	0.261	0.217	0.261	0.178	0.266	0.227	0.245	0.225	0.242	0.183	0.260
		Avg	0.163	0.225	0.169	0.282	0.196	0.310	0.169	0.228	0.183	0.257	0.154	0.266	0.177	0.221	0.175	0.219	0.153	0.244

Table 16: Detailed forecasting results on Agriculture, Climate, and Economy under textual perturbation ratio $\rho = 0.9$. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Uni-modal	6	0.078	0.205	0.173	0.303	0.156	0.302	0.074	0.195	0.066	0.160	0.272	0.384	0.067	0.180	0.059	0.160	0.199	0.315
		8	0.091	0.217	0.266	0.373	0.173	0.320	0.090	0.219	0.084	0.183	0.315	0.403	0.079	0.188	0.079	0.183	0.208	0.311
		10	0.110	0.248	0.362	0.450	0.206	0.343	0.105	0.247	0.108	0.209	0.490	0.530	0.102	0.219	0.101	0.206	0.305	0.390
		12	0.134	0.269	0.436	0.495	0.247	0.371	0.132	0.273	0.142	0.241	0.578	0.567	0.134	0.247	0.131	0.238	0.419	0.451
		Avg	0.103	0.235	0.309	0.405	0.195	0.334	0.100	0.234	0.100	0.198	0.414	0.471	0.096	0.209	0.093	0.197	0.283	0.367
	MM-TSFLib	6	0.076	0.199	0.139	0.260	0.095	0.209	0.073	0.194	0.067	0.161	0.204	0.320	0.070	0.199	0.061	0.163	0.159	0.277
		8	0.093	0.223	0.244	0.353	0.132	0.257	0.091	0.219	0.085	0.184	0.258	0.361	0.092	0.225	0.078	0.182	0.210	0.320
		10	0.108	0.249	0.269	0.368	0.154	0.273	0.108	0.247	0.110	0.211	0.393	0.458	0.111	0.240	0.098	0.204	0.253	0.347
		12	0.133	0.273	0.336	0.407	0.193	0.298	0.134	0.268	0.139	0.236	0.527	0.541	0.136	0.261	0.131	0.235	0.301	0.374
		Avg	0.103	0.236	0.247	0.347	0.144	0.259	0.101	0.232	0.100	0.198	0.346	0.420	0.102	0.231	0.092	0.196	0.231	0.330
	TaTS	6	0.073	0.191	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.118	0.251	0.064	0.176	0.060	0.161	0.097	0.249
		8	0.095	0.215	0.155	0.275	0.133	0.264	0.089	0.222	0.083	0.181	0.164	0.290	0.080	0.188	0.078	0.181	0.124	0.265
		10	0.109	0.248	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.231	0.329	0.101	0.212	0.100	0.204	0.177	0.290
		12	0.137	0.281	0.255	0.339	0.194	0.308	0.131	0.272	0.139	0.236	0.340	0.403	0.131	0.240	0.131	0.235	0.233	0.323
		Avg	0.104	0.234	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.213	0.318	0.094	0.204	0.092	0.195	0.158	0.282
	PA-RNet	6	0.075	0.195	0.093	0.220	0.118	0.249	0.074	0.191	0.065	0.159	0.118	0.254	0.065	0.178	0.060	0.161	0.100	0.247
		8	0.092	0.226	0.146	0.261	0.135	0.264	0.087	0.215	0.084	0.182	0.167	0.288	0.081	0.193	0.077	0.181	0.124	0.262
		10	0.107	0.244	0.196	0.293	0.158	0.283	0.107	0.239	0.108	0.208	0.238	0.336	0.101	0.212	0.099	0.203	0.166	0.292
		12	0.137	0.275	0.252	0.329	0.190	0.307	0.131	0.267	0.139	0.235	0.321	0.390	0.132	0.247	0.129	0.236	0.235	0.321
		Avg	0.103	0.235	0.172	0.276	0.150	0.276	0.100	0.228	0.099	0.196	0.211	0.317	0.095	0.208	0.091	0.195	0.156	0.280
Climate	Uni-modal	6	1.315	0.930	1.151	0.844	1.309	0.929	1.093	0.834	1.337	0.940	1.118	0.821	1.160	0.892	1.285	0.925	1.058	0.798
		8	1.296	0.924	1.153	0.846	1.270	0.918	1.136	0.849	1.380	0.967	1.158	0.845	1.206	0.901	1.300	0.933	1.058	0.799
		10	1.280	0.919	1.149	0.850	1.295	0.928	1.199	0.891	1.387	0.972	1.193	0.866	1.233	0.909	1.306	0.939	1.091	0.829
		12	1.264	0.904	1.205	0.875	1.258	0.909	1.176	0.882	1.369	0.965	1.202	0.866	1.196	0.897	1.292	0.933	1.041	0.803
		Avg	1.289	0.919	1.165	0.854	1.283	0.921	1.151	0.864	1.368	0.961	1.168	0.850	1.199	0.900	1.296	0.933	1.062	0.807
	MM-TSFLib	6	1.123	0.862	1.160	0.838	1.104	0.853	0.997	0.800	1.185	0.883	1.176	0.847	1.058	0.848	1.128	0.869	1.037	0.790
		8	1.131	0.860	1.112	0.829	1.113	0.856	1.026	0.814	1.190	0.896	1.097	0.823	1.137	0.874	1.149	0.872	1.032	0.793
		10	1.155	0.864	1.114	0.834	1.096	0.848	1.068	0.834	1.205	0.902	1.087	0.820	1.109	0.859	1.175	0.880	1.015	0.790
		12	1.140	0.860	1.111	0.838	1.106	0.847	1.071	0.833	1.188	0.895	1.121	0.835	1.112	0.862	1.148	0.872	1.036	0.803
		Avg	1.137	0.861	1.124	0.835	1.105	0.851	1.041	0.820	1.192	0.894	1.120	0.831	1.104	0.861	1.150	0.873	1.030	0.794
	TaTS	6	1.003	0.807	1.027	0.778	0.929	0.771	0.909	0.765	0.969	0.784	1.033	0.789	0.991	0.800	0.974	0.793	0.914	0.740
		8	1.016	0.813	1.020	0.782	0.942	0.776	0.940	0.774	0.974	0.793	0.990	0.779	1.024	0.810	0.986	0.788	0.933	0.748
		10	1.001	0.810	1.029	0.790	0.963	0.783	0.996	0.800	0.997	0.803	0.984	0.781	1.021	0.809	1.023	0.808	0.998	0.778
		12	0.965	0.791	1.054	0.804	0.967	0.781	1.004	0.811	1.002	0.806	1.021	0.796	1.048	0.822	1.021	0.809	0.978	0.776
		Avg	0.996	0.805	1.033	0.789	0.950	0.778	0.962	0.788	0.986	0.797	1.007	0.786	1.021	0.810	1.001	0.800	0.956	0.761
	PA-RNet	6	1.028	0.824	0.994	0.772	0.924	0.768	0.919	0.765	0.971	0.784	0.971	0.777	0.996	0.798	0.950	0.780	0.913	0.736
		8	0.954	0.788	1.031	0.785	0.940	0.774	0.939	0.776	0.970	0.791	0.958	0.766	0.994	0.795	0.973	0.785	0.954	0.757
		10	0.945	0.781	1.016	0.785	0.960	0.782	0.987	0.804	0.992	0.801	0.960	0.767	1.029	0.812	1.015	0.806	1.000	0.781
		12	0.959	0.785	1.017	0.787	0.968	0.782	0.984	0.797	1.001	0.805	0.979	0.777	1.042	0.821	1.029	0.812	1.009	0.791
		Avg	0.972	0.795	1.015	0.782	0.948	0.777	0.957	0.786	0.983	0.795	0.967	0.772	1.015	0.807	0.992	0.796	0.969	0.766
Economy	Uni-modal	6	0.085	0.234	0.265	0.440	0.094	0.257	0.096	0.234	0.017	0.103	0.496	0.665	0.016	0.098	0.020	0.108	0.207	0.351
		8	0.097	0.247	0.344	0.531	0.101	0.271	0.072	0.210	0.018	0.109	0.580	0.722	0.016	0.098	0.019	0.109	0.119	0.268
		10	0.075	0.213	0.817	0.776	0.116	0.288	0.064	0.199	0.018	0.109	0.530	0.687	0.016	0.098	0.018	0.105	0.121	0.270
		12	0.074	0.216	0.837	0.821	0.141	0.309	0.077	0.221	0.018	0.110	0.680	0.776	0.016	0.099	0.018	0.105	0.071	0.216
		Avg	0.083	0.227	0.566	0.642	0.113	0.281	0.077	0.216	0.018	0.108	0.572	0.712	0.016	0.098	0.019	0.107	0.129	0.276
	MM-TSFLib	6	0.093	0.238	0.401	0.502	0.042	0.165	0.081	0.220	0.017	0.104	0.414	0.598	0.016	0.096	0.020	0.109	0.144	0.303
		8	0.090	0.232	0.366	0.515	0.054	0.184	0.070	0.205	0.018	0.109	0.434	0.621	0.016	0.096	0.019	0.108	0.166	0.326
		10	0.079	0.219	0.370	0.560	0.048	0.174	0.061	0.195	0.018	0.108	0.502	0.665	0.016	0.100	0.018	0.105	0.185	0.359
		12	0.079	0.214	0.476	0.630	0.056	0.179	0.069	0.208	0.018	0.110	0.553	0.701	0.016	0.098	0.018	0.107	0.181	0.361
		Avg	0.085	0.226	0.403	0.552	0.050	0.176	0.070	0.207	0.018	0.108	0.476	0.646	0.016	0.098	0.019	0.107	0.169	0.337
	TaTS	6	0.029	0.134	0.105	0.282	0.017	0.106	0.040	0.153	0.011	0.087	0.205	0.409	0.011	0.085	0.011	0.086	0.063	0.208
		8	0.032	0.144	0.135	0.324	0.016	0.103	0.037	0.145	0.010	0.085	0.296	0.496	0.011	0.085	0.011	0.087	0.100	0.266
		10	0.024	0.122	0.187	0.375	0.015	0.099	0.030	0.132	0.010	0.084	0.347	0.557	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.025	0.125	0.218	0.410	0.015	0.099	0.038	0.150	0.010	0.083	0.386	0.585	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.027	0.131	0.161	0.348	0.016	0.102	0.036	0.145	0.010	0.085	0.309	0.512	0.011	0.085	0.011	0.086	0.133	0.311
	PA-RNet	6	0.024	0.125	0.087	0.251	0.018	0.108	0.036	0.144	0.011	0.086	0.145	0.334	0.011	0.085	0.011	0.087	0.070	0.219
		8	0.028	0.132	0.132	0.313	0.016	0.103	0.035	0.142	0.010	0.085	0.254	0.464	0.010	0.085	0.011	0.087	0.128	0.296
		10	0.023	0.121	0.214	0.423	0.015	0.099	0.032	0.134	0.010	0.084	0.340	0.539	0.010	0.084	0.010	0.085	0.166	0.360
		12	0.020	0.113	0.226	0.429	0.015	0.099	0.038	0.146	0.010	0.083	0.449	0.632	0.010	0.082	0.010	0.084	0.137	0.306
		Avg	0.024	0.123	0.165	0.354	0.016	0.102	0.035	0.142	0.010	0.085	0.297	0.492	0.010	0.084	0.011	0.086	0.125	0.295

Table 17: Detailed forecasting results on Health, Security, and Traffic under textual perturbation ratio $\rho = 0.9$. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Health	Uni-modal	12	1.512	0.919	1.166	0.722	1.487	0.824	1.131	0.787	1.244	0.749	1.250	0.765	1.061	0.626	0.962	0.624	1.358	0.803
		24	1.875	1.025	1.404	0.785	1.636	0.866	1.549	0.964	1.525	0.832	1.642	0.819	1.811	0.784	1.578	0.758	1.393	0.761
		36	1.971	1.040	1.452	0.801	1.673	0.885	1.622	0.982	1.692	0.891	1.534	0.824	2.187	0.885	1.908	0.857	1.555	0.793
		48	1.881	0.987	1.493	0.814	1.717	0.906	1.647	0.980	1.790	0.931	1.662	0.865	2.240	0.928	2.131	0.911	1.533	0.835
		Avg	1.810	0.993	1.379	0.781	1.628	0.870	1.487	0.928	1.563	0.851	1.522	0.818	1.825	0.806	1.645	0.788	1.460	0.798
	MM-TSFLib	12	1.523	0.918	1.077	0.681	1.405	0.804	1.171	0.795	1.186	0.733	1.085	0.712	1.006	0.624	0.907	0.614	1.179	0.767
		24	1.780	0.977	1.353	0.786	1.534	0.824	1.450	0.913	1.454	0.814	1.425	0.780	1.641	0.770	1.355	0.722	1.263	0.706
		36	1.762	0.966	1.337	0.755	1.579	0.852	1.474	0.910	1.562	0.846	1.476	0.798	1.868	0.842	1.679	0.811	1.335	0.774
		48	1.827	0.967	1.448	0.789	1.631	0.879	1.498	0.905	1.655	0.885	1.552	0.819	1.947	0.893	1.862	0.874	1.469	0.797
		Avg	1.723	0.957	1.304	0.753	1.537	0.840	1.398	0.881	1.464	0.819	1.385	0.777	1.616	0.782	1.451	0.755	1.312	0.761
	TaTS	12	1.402	0.875	0.921	0.652	1.282	0.765	1.120	0.767	1.123	0.711	0.970	0.666	0.880	0.608	0.795	0.594	0.913	0.641
		24	1.464	0.865	1.221	0.744	1.399	0.790	1.381	0.863	1.362	0.786	1.180	0.724	1.323	0.724	1.198	0.707	1.125	0.709
		36	1.542	0.882	1.266	0.726	1.449	0.809	1.423	0.867	1.421	0.801	1.214	0.734	1.585	0.807	1.453	0.777	1.190	0.717
		48	1.580	0.898	1.341	0.759	1.504	0.834	1.476	0.889	1.495	0.837	1.307	0.777	1.716	0.854	1.592	0.822	1.294	0.751
		Avg	1.497	0.880	1.187	0.720	1.409	0.800	1.350	0.847	1.350	0.784	1.168	0.725	1.376	0.748	1.260	0.725	1.131	0.705
	PA-RNet	12	1.363	0.852	0.966	0.677	1.287	0.766	1.068	0.742	1.125	0.712	0.957	0.669	0.909	0.618	0.783	0.592	0.935	0.655
		24	1.502	0.891	1.230	0.733	1.398	0.789	1.380	0.865	1.344	0.775	1.137	0.703	1.296	0.722	1.149	0.693	1.147	0.704
		36	1.513	0.877	1.250	0.734	1.442	0.810	1.414	0.863	1.420	0.801	1.220	0.734	1.593	0.815	1.446	0.777	1.144	0.695
		48	1.561	0.888	1.370	0.772	1.509	0.830	1.461	0.880	1.499	0.838	1.306	0.774	1.708	0.859	1.619	0.827	1.280	0.751
		Avg	1.485	0.877	1.204	0.729	1.409	0.799	1.331	0.837	1.347	0.782	1.155	0.720	1.377	0.754	1.249	0.722	1.127	0.701
Social Good	Uni-modal	6	1.026	0.557	0.765	0.428	0.928	0.519	0.945	0.464	0.885	0.424	0.759	0.388	1.083	0.562	0.914	0.474	0.732	0.392
		8	1.095	0.585	0.833	0.455	1.018	0.562	1.170	0.510	1.080	0.497	0.791	0.412	1.155	0.568	1.046	0.526	0.814	0.422
		10	1.144	0.596	0.892	0.500	1.057	0.585	1.251	0.546	1.208	0.576	0.827	0.426	1.171	0.603	1.094	0.526	0.830	0.445
		12	1.247	0.634	0.926	0.501	1.159	0.629	1.352	0.589	1.300	0.600	0.845	0.461	1.248	0.637	1.152	0.541	0.898	0.449
		Avg	1.128	0.593	0.854	0.471	1.041	0.574	1.180	0.527	1.118	0.524	0.805	0.422	1.164	0.593	1.052	0.517	0.819	0.427
	MM-TSFLib	6	0.990	0.568	0.755	0.428	0.940	0.532	0.924	0.475	0.871	0.466	0.734	0.377	1.010	0.497	0.902	0.501	0.776	0.403
		8	1.031	0.569	0.838	0.479	0.984	0.557	1.114	0.519	1.013	0.528	0.782	0.425	1.018	0.529	1.047	0.558	0.835	0.433
		10	1.114	0.603	0.876	0.489	1.043	0.589	1.203	0.568	1.101	0.559	0.834	0.452	1.088	0.541	1.048	0.539	0.883	0.462
		12	1.206	0.663	0.916	0.517	1.112	0.626	1.288	0.604	1.163	0.585	0.830	0.455	1.135	0.558	1.119	0.566	0.878	0.475
		Avg	1.085	0.601	0.846	0.478	1.020	0.576	1.132	0.542	1.037	0.535	0.795	0.427	1.063	0.531	1.029	0.541	0.843	0.443
	TaTS	6	0.949	0.533	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.754	0.378	1.055	0.642	0.969	0.532	0.777	0.399
		8	1.044	0.588	0.816	0.461	1.030	0.575	1.056	0.557	1.013	0.509	0.813	0.412	1.074	0.638	0.929	0.468	0.840	0.424
		10	1.121	0.641	0.885	0.497	1.044	0.585	1.131	0.603	1.108	0.556	0.882	0.456	1.125	0.674	1.057	0.531	0.857	0.430
		12	1.159	0.643	0.923	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.845	0.441	1.184	0.704	1.221	0.546	0.855	0.456
		Avg	1.068	0.601	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.823	0.422	1.110	0.665	1.044	0.519	0.832	0.427
	PA-RNet	6	0.985	0.540	0.756	0.420	0.917	0.522	0.954	0.519	0.854	0.429	0.752	0.403	1.178	0.545	0.970	0.523	0.760	0.398
		8	1.091	0.625	0.827	0.449	1.004	0.563	1.115	0.572	0.998	0.497	0.795	0.401	1.139	0.611	0.995	0.473	0.777	0.417
		10	1.113	0.612	0.881	0.491	1.034	0.578	1.080	0.581	1.104	0.551	0.838	0.414	1.265	0.665	1.072	0.496	0.848	0.431
		12	1.174	0.655	0.901	0.481	1.109	0.612	1.159	0.607	1.176	0.581	0.851	0.463	1.187	0.596	1.128	0.536	0.896	0.476
		Avg	1.091	0.608	0.841	0.460	1.016	0.569	1.077	0.570	1.033	0.515	0.809	0.420	1.192	0.604	1.041	0.507	0.820	0.431
Traffic	Uni-modal	6	0.178	0.265	0.190	0.320	0.342	0.458	0.186	0.265	0.261	0.365	0.145	0.280	0.168	0.233	0.168	0.233	0.153	0.268
		8	0.160	0.243	0.193	0.322	0.316	0.434	0.185	0.264	0.241	0.318	0.159	0.302	0.181	0.235	0.178	0.237	0.150	0.265
		10	0.196	0.288	0.195	0.313	0.305	0.421	0.186	0.263	0.237	0.307	0.152	0.279	0.186	0.237	0.187	0.238	0.156	0.275
		12	0.243	0.297	0.224	0.318	0.337	0.438	0.256	0.304	0.276	0.328	0.198	0.320	0.243	0.263	0.239	0.259	0.192	0.282
		Avg	0.194	0.273	0.201	0.318	0.325	0.438	0.203	0.274	0.254	0.330	0.163	0.295	0.194	0.242	0.193	0.242	0.163	0.273
	MM-TSFLib	6	0.166	0.257	0.180	0.308	0.251	0.381	0.165	0.245	0.238	0.337	0.159	0.298	0.157	0.225	0.160	0.231	0.149	0.261
		8	0.179	0.268	0.188	0.314	0.246	0.369	0.169	0.244	0.218	0.298	0.155	0.288	0.173	0.233	0.170	0.235	0.156	0.273
		10	0.174	0.269	0.189	0.308	0.240	0.364	0.178	0.256	0.224	0.305	0.164	0.301	0.179	0.238	0.180	0.240	0.158	0.274
		12	0.241	0.300	0.219	0.314	0.253	0.362	0.240	0.294	0.273	0.337	0.195	0.303	0.235	0.266	0.239	0.273	0.196	0.284
		Avg	0.190	0.274	0.194	0.311	0.248	0.369	0.188	0.260	0.238	0.319	0.168	0.298	0.186	0.241	0.187	0.245	0.165	0.273
	TaTS	6	0.141	0.207	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.138	0.250	0.159	0.211	0.149	0.206	0.138	0.244
		8	0.148	0.216	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.143	0.267	0.170	0.217	0.161	0.211	0.142	0.254
		10	0.155	0.224	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.146	0.269	0.172	0.218	0.169	0.217	0.144	0.255
		12	0.213	0.255	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.182	0.296	0.230	0.246	0.226	0.242	0.180	0.270
		Avg	0.164	0.226	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.152	0.271	0.183	0.223	0.176	0.219	0.151	0.256
	PA-RNet	6	0.143	0.215	0.156	0.276	0.190	0.311	0.153	0.214	0.171	0.272	0.137	0.238	0.152	0.208	0.148	0.205	0.136	0.222
		8	0.150	0.214	0.161	0.280	0.187	0.306	0.152	0.211	0.172	0.248	0.136	0.234	0.165	0.215	0.160	0.213	0.142	0.238
		10	0.152	0.221	0.164	0.284	0.189	0.310	0.160	0.225	0.173	0.246	0.143	0.253	0.168	0.216	0.168	0.215	0.143	0.242
		12	0.212	0.253	0.194	0.290	0.217	0.313	0.215	0.259	0.217	0.261	0.178	0.254	0.227	0.245	0.225	0.242	0.183	0.257
		Avg	0.164	0.226	0.169	0.283	0.196	0.310	0.170	0.227	0.183	0.257	0.149	0.245	0.178	0.221	0.175	0.219	0.151	0.240

G Results under Different Text Perturbation Strategies

We adopt Transformer as the backbone model and evaluate robustness against textual perturbations on six datasets. The experiments cover five perturbation strategies—Generalize, Reverse, Shuffle, Insert, and Truncate—each applied at four perturbation ratios (0.3, 0.5, 0.7, 0.9) to generate corrupted samples.The results are reported in Table 18.

Table 18: Performance of PA-RNet under Five Text Perturbation Strategies (Generalize, Reverse, Shuffle, Insert, Truncate). Lower MSE/MAE indicates better performance.

Dataset	T	Generalize		Reverse		Shuffle		Insert		Truncate		All	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Original	0.153	0.279	0.153	0.279	0.153	0.279	0.153	0.279	0.153	0.279	0.153	0.279
	ρ=0.3	0.158	0.281	0.156	0.282	0.153	0.280	0.158	0.282	0.153	0.279	0.156	0.282
	ρ=0.5	0.158	0.282	0.156	0.279	0.153	0.279	0.155	0.279	0.153	0.279	0.158	0.281
	ρ=0.7	0.158	0.281	0.154	0.280	0.153	0.279	0.157	0.281	0.153	0.279	0.156	0.278
	ρ=0.9	0.156	0.282	0.158	0.283	0.154	0.280	0.158	0.282	0.153	0.279	0.156	0.280
	ρ Avg	0.158	0.282	0.156	0.281	0.153	0.280	0.157	0.281	0.153	0.279	0.157	0.280
Climate	Original	0.970	0.766	0.970	0.766	0.970	0.766	0.970	0.766	0.970	0.766	0.970	0.766
	ρ=0.3	0.963	0.763	0.969	0.765	0.971	0.766	0.970	0.766	0.970	0.766	0.962	0.764
	ρ=0.5	0.968	0.766	0.971	0.767	0.970	0.766	0.963	0.764	0.970	0.766	0.969	0.766
	ρ=0.7	0.972	0.768	0.969	0.766	0.970	0.766	0.969	0.766	0.970	0.766	0.973	0.769
	ρ=0.9	0.972	0.767	0.970	0.767	0.971	0.766	0.967	0.765	0.971	0.766	0.969	0.766
	ρ Avg	0.969	0.766	0.970	0.766	0.971	0.766	0.967	0.765	0.970	0.766	0.968	0.766
Economy	Original	0.113	0.280	0.113	0.280	0.113	0.280	0.113	0.280	0.113	0.280	0.113	0.280
	ρ=0.3	0.117	0.281	0.098	0.254	0.113	0.280	0.112	0.278	0.112	0.279	0.120	0.295
	ρ=0.5	0.170	0.326	0.112	0.277	0.111	0.277	0.108	0.273	0.113	0.280	0.131	0.301
	ρ=0.7	0.123	0.290	0.115	0.287	0.113	0.281	0.103	0.264	0.113	0.280	0.158	0.341
	ρ=0.9	0.125	0.293	0.100	0.264	0.113	0.281	0.111	0.278	0.113	0.281	0.125	0.295
	ρ Avg	0.134	0.298	0.106	0.271	0.113	0.280	0.109	0.273	0.113	0.280	0.134	0.308
Health	Original	1.126	0.700	1.126	0.700	1.126	0.700	1.126	0.700	1.126	0.700	1.126	0.700
	ρ=0.3	1.142	0.707	1.121	0.698	1.140	0.707	1.121	0.700	1.126	0.700	1.143	0.706
	ρ=0.5	1.120	0.697	1.144	0.705	1.124	0.702	1.131	0.703	1.127	0.700	1.144	0.706
	ρ=0.7	1.128	0.701	1.136	0.704	1.141	0.706	1.120	0.699	1.125	0.699	1.145	0.707
	ρ=0.9	1.129	0.702	1.132	0.703	1.121	0.699	1.112	0.696	1.126	0.700	1.127	0.701
	ρ Avg	1.130	0.702	1.133	0.703	1.132	0.704	1.121	0.700	1.126	0.700	1.140	0.705
Social Good	Original	0.819	0.421	0.819	0.421	0.819	0.421	0.819	0.421	0.819	0.421	0.819	0.421
	ρ=0.3	0.821	0.428	0.819	0.425	0.823	0.426	0.825	0.426	0.823	0.428	0.816	0.422
	ρ=0.5	0.826	0.430	0.821	0.426	0.823	0.425	0.824	0.425	0.823	0.426	0.826	0.429
	ρ=0.7	0.819	0.426	0.824	0.426	0.823	0.425	0.826	0.428	0.823	0.428	0.821	0.428
	ρ=0.9	0.820	0.428	0.823	0.426	0.823	0.426	0.821	0.427	0.823	0.426	0.824	0.433
	ρ Avg	0.822	0.428	0.822	0.426	0.823	0.426	0.824	0.427	0.823	0.427	0.822	0.428
Traffic	Original	0.155	0.244	0.155	0.244	0.155	0.244	0.155	0.244	0.155	0.244	0.155	0.244
	ρ=0.3	0.154	0.251	0.153	0.243	0.155	0.244	0.156	0.246	0.155	0.244	0.158	0.255
	ρ=0.5	0.153	0.255	0.153	0.246	0.155	0.245	0.154	0.243	0.155	0.244	0.153	0.250
	ρ=0.7	0.154	0.255	0.155	0.252	0.155	0.245	0.155	0.245	0.155	0.244	0.153	0.244
	ρ=0.9	0.153	0.242	0.155	0.243	0.154	0.244	0.154	0.245	0.155	0.244	0.151	0.240
	ρ Avg	0.154	0.251	0.154	0.246	0.155	0.245	0.155	0.245	0.155	0.244	0.154	0.247

Table 19: Complete forecasting results of PA-RNet under five text perturbation strategies (generalize, reverse, shuffle, insert, and truncate) at perturbation ratio $\rho = 0.3$. Lower MSE/MAE indicates better performance.

Dataset	T	Generalize		Reverse		Shuffle		Insert		Truncate		All	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	6	0.098	0.244	0.101	0.250	0.100	0.250	0.100	0.247	0.098	0.246	0.101	0.251
	8	0.127	0.264	0.122	0.265	0.123	0.265	0.121	0.262	0.122	0.263	0.121	0.263
	10	0.169	0.292	0.166	0.291	0.167	0.289	0.171	0.293	0.167	0.289	0.169	0.292
	12	0.238	0.324	0.233	0.320	0.222	0.317	0.238	0.324	0.224	0.318	0.234	0.320
	Avg	0.158	0.281	0.156	0.282	0.153	0.280	0.158	0.282	0.153	0.279	0.156	0.282
Climate	6	0.909	0.733	0.915	0.735	0.918	0.736	0.916	0.737	0.917	0.736	0.910	0.735
	8	0.952	0.756	0.953	0.756	0.955	0.757	0.951	0.756	0.954	0.757	0.951	0.756
	10	0.984	0.775	0.990	0.777	0.988	0.777	0.993	0.779	0.989	0.777	0.994	0.781
	12	1.009	0.789	1.020	0.793	1.023	0.795	1.018	0.793	1.022	0.795	0.993	0.783
	Avg	0.963	0.763	0.969	0.765	0.971	0.766	0.970	0.766	0.970	0.766	0.962	0.764
Economy	6	0.062	0.204	0.067	0.214	0.054	0.187	0.052	0.184	0.054	0.187	0.076	0.231
	8	0.086	0.242	0.060	0.197	0.085	0.244	0.085	0.246	0.083	0.242	0.128	0.309
	10	0.178	0.377	0.112	0.277	0.140	0.330	0.161	0.359	0.140	0.330	0.126	0.310
	12	0.143	0.302	0.153	0.326	0.173	0.360	0.149	0.322	0.171	0.358	0.151	0.329
	Avg	0.117	0.281	0.098	0.254	0.113	0.280	0.112	0.278	0.112	0.279	0.120	0.295
Health	12	0.956	0.664	0.870	0.631	0.939	0.655	0.872	0.633	0.882	0.636	0.971	0.668
	24	1.153	0.706	1.151	0.704	1.154	0.706	1.146	0.704	1.156	0.706	1.148	0.705
	36	1.176	0.711	1.175	0.710	1.175	0.714	1.175	0.714	1.174	0.709	1.180	0.710
	48	1.284	0.745	1.288	0.746	1.290	0.754	1.290	0.747	1.292	0.748	1.274	0.741
	Avg	1.142	0.707	1.121	0.698	1.140	0.707	1.121	0.700	1.126	0.700	1.143	0.706
Social Good	6	0.755	0.385	0.747	0.374	0.766	0.383	0.763	0.380	0.765	0.383	0.760	0.374
	8	0.827	0.424	0.827	0.423	0.824	0.424	0.828	0.432	0.824	0.433	0.811	0.418
	10	0.840	0.437	0.839	0.427	0.839	0.429	0.844	0.427	0.839	0.429	0.841	0.429
	12	0.864	0.465	0.865	0.474	0.863	0.467	0.863	0.465	0.864	0.467	0.852	0.467
	Avg	0.821	0.428	0.819	0.425	0.823	0.426	0.825	0.426	0.823	0.428	0.816	0.422
Traffic	6	0.142	0.248	0.137	0.231	0.142	0.237	0.142	0.238	0.142	0.237	0.145	0.247
	8	0.144	0.247	0.144	0.246	0.145	0.242	0.147	0.250	0.145	0.242	0.150	0.256
	10	0.145	0.244	0.147	0.240	0.148	0.242	0.149	0.242	0.148	0.242	0.152	0.254
	12	0.184	0.266	0.185	0.255	0.184	0.256	0.186	0.254	0.184	0.256	0.187	0.263
	Avg	0.154	0.251	0.153	0.243	0.155	0.244	0.156	0.246	0.155	0.244	0.158	0.255

Table 20: Complete forecasting results of PA-RNet under five text perturbation strategies (generalize, reverse, shuffle, insert, and truncate) at perturbation ratio $\rho = 0.5$. Lower MSE/MAE indicates better performance.

Dataset	T	Generalize		Reverse		Shuffle		Insert		Truncate		All	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	6	0.101	0.250	0.100	0.245	0.100	0.247	0.101	0.244	0.098	0.245	0.099	0.244
	8	0.124	0.265	0.121	0.262	0.122	0.263	0.126	0.265	0.122	0.263	0.122	0.262
	10	0.171	0.292	0.167	0.290	0.167	0.289	0.168	0.289	0.167	0.289	0.175	0.296
	12	0.235	0.321	0.236	0.321	0.224	0.317	0.223	0.318	0.224	0.318	0.237	0.322
	Avg	0.158	0.282	0.156	0.279	0.153	0.279	0.155	0.279	0.153	0.279	0.158	0.281
Climate	6	0.913	0.735	0.913	0.735	0.917	0.736	0.914	0.736	0.917	0.736	0.916	0.736
	8	0.950	0.755	0.957	0.759	0.955	0.757	0.954	0.757	0.954	0.757	0.953	0.757
	10	0.993	0.779	0.999	0.782	0.988	0.777	0.988	0.777	0.989	0.777	0.996	0.781
	12	1.018	0.793	1.014	0.792	1.022	0.795	0.995	0.784	1.022	0.795	1.010	0.791
	Avg	0.968	0.766	0.971	0.767	0.970	0.766	0.963	0.764	0.970	0.766	0.969	0.766
Economy	6	0.085	0.243	0.058	0.196	0.054	0.186	0.054	0.187	0.054	0.187	0.067	0.213
	8	0.076	0.228	0.090	0.245	0.079	0.234	0.095	0.263	0.085	0.245	0.099	0.264
	10	0.195	0.359	0.147	0.339	0.142	0.333	0.139	0.330	0.141	0.332	0.113	0.279
	12	0.324	0.472	0.154	0.329	0.170	0.356	0.142	0.312	0.172	0.358	0.245	0.447
	Avg	0.170	0.326	0.112	0.277	0.111	0.277	0.108	0.273	0.113	0.280	0.131	0.301
Health	12	0.897	0.643	0.962	0.660	0.878	0.636	0.900	0.642	0.881	0.636	0.933	0.650
	24	1.154	0.706	1.151	0.705	1.155	0.706	1.148	0.704	1.157	0.707	1.174	0.712
	36	1.145	0.694	1.173	0.709	1.177	0.713	1.184	0.718	1.175	0.709	1.178	0.715
	48	1.285	0.745	1.288	0.747	1.287	0.753	1.290	0.748	1.293	0.748	1.289	0.746
	Avg	1.120	0.697	1.144	0.705	1.124	0.702	1.131	0.703	1.127	0.700	1.144	0.706
Social Good	6	0.757	0.388	0.756	0.375	0.764	0.380	0.768	0.387	0.766	0.386	0.774	0.390
	8	0.825	0.426	0.822	0.429	0.827	0.427	0.826	0.425	0.824	0.425	0.818	0.426
	10	0.858	0.446	0.843	0.431	0.839	0.429	0.841	0.426	0.839	0.428	0.843	0.427
	12	0.864	0.461	0.863	0.467	0.863	0.465	0.860	0.463	0.863	0.466	0.869	0.471
	Avg	0.826	0.430	0.821	0.426	0.823	0.425	0.824	0.425	0.823	0.426	0.826	0.429
Traffic	6	0.139	0.246	0.138	0.238	0.142	0.237	0.142	0.236	0.142	0.236	0.140	0.242
	8	0.143	0.253	0.141	0.243	0.145	0.244	0.145	0.241	0.145	0.242	0.142	0.247
	10	0.148	0.255	0.149	0.247	0.147	0.241	0.147	0.238	0.148	0.242	0.146	0.249
	12	0.181	0.266	0.182	0.254	0.185	0.256	0.184	0.258	0.184	0.256	0.183	0.260
	Avg	0.153	0.255	0.153	0.246	0.155	0.245	0.154	0.243	0.155	0.244	0.153	0.250

Table 21: Complete forecasting results of PA-RNet under five text perturbation strategies (generalize, reverse, shuffle, insert, and truncate) at perturbation ratio $\rho = 0.7$. Lower MSE/MAE indicates better performance.

Dataset	T	Generalize		Reverse		Shuffle		Insert		Truncate		All	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	6	0.101	0.247	0.100	0.245	0.099	0.246	0.100	0.249	0.098	0.246	0.096	0.238
	8	0.125	0.264	0.120	0.263	0.122	0.262	0.121	0.262	0.122	0.263	0.124	0.260
	10	0.169	0.292	0.169	0.292	0.168	0.291	0.167	0.290	0.169	0.291	0.165	0.289
	12	0.235	0.322	0.228	0.321	0.224	0.318	0.238	0.324	0.224	0.317	0.237	0.324
	Avg	0.158	0.281	0.154	0.280	0.153	0.279	0.157	0.281	0.153	0.279	0.156	0.278
Climate	6	0.934	0.744	0.916	0.736	0.917	0.737	0.914	0.735	0.916	0.736	0.913	0.736
	8	0.951	0.756	0.956	0.758	0.954	0.757	0.953	0.757	0.954	0.757	0.967	0.764
	10	0.995	0.780	0.993	0.779	0.989	0.777	0.987	0.777	0.989	0.777	0.999	0.782
	12	1.010	0.790	1.012	0.792	1.019	0.794	1.021	0.795	1.023	0.795	1.013	0.792
	Avg	0.972	0.768	0.969	0.766	0.970	0.766	0.969	0.766	0.970	0.766	0.973	0.769
Economy	6	0.083	0.248	0.053	0.185	0.053	0.186	0.054	0.187	0.054	0.186	0.080	0.234
	8	0.093	0.252	0.121	0.307	0.085	0.245	0.069	0.217	0.084	0.244	0.139	0.330
	10	0.112	0.278	0.173	0.373	0.143	0.334	0.135	0.323	0.142	0.333	0.198	0.398
	12	0.203	0.382	0.115	0.282	0.172	0.359	0.155	0.329	0.172	0.358	0.215	0.400
	Avg	0.123	0.290	0.115	0.287	0.113	0.281	0.103	0.264	0.113	0.280	0.158	0.341
Health	12	0.898	0.644	0.934	0.653	0.935	0.653	0.875	0.635	0.879	0.635	0.933	0.654
	24	1.152	0.706	1.150	0.704	1.167	0.711	1.149	0.705	1.157	0.707	1.179	0.714
	36	1.175	0.708	1.179	0.712	1.171	0.713	1.175	0.712	1.170	0.707	1.184	0.714
	48	1.286	0.746	1.279	0.748	1.291	0.748	1.282	0.744	1.293	0.748	1.283	0.746
	Avg	1.128	0.701	1.136	0.704	1.141	0.706	1.120	0.699	1.125	0.699	1.145	0.707
Social Good	6	0.763	0.393	0.764	0.382	0.765	0.383	0.768	0.388	0.765	0.383	0.752	0.392
	8	0.811	0.420	0.830	0.427	0.825	0.424	0.827	0.429	0.826	0.433	0.824	0.427
	10	0.837	0.428	0.838	0.429	0.840	0.429	0.841	0.427	0.839	0.428	0.843	0.429
	12	0.866	0.462	0.863	0.467	0.862	0.464	0.869	0.469	0.863	0.466	0.863	0.462
	Avg	0.819	0.426	0.824	0.426	0.823	0.425	0.826	0.428	0.823	0.428	0.821	0.428
Traffic	6	0.142	0.246	0.143	0.247	0.142	0.237	0.142	0.235	0.142	0.237	0.139	0.235
	8	0.145	0.253	0.145	0.250	0.145	0.243	0.146	0.247	0.145	0.242	0.143	0.239
	10	0.147	0.249	0.148	0.250	0.148	0.242	0.148	0.243	0.148	0.242	0.146	0.241
	12	0.183	0.272	0.184	0.260	0.184	0.256	0.184	0.255	0.184	0.256	0.183	0.260
	Avg	0.154	0.255	0.155	0.252	0.155	0.245	0.155	0.245	0.155	0.244	0.153	0.244

Table 22: Complete forecasting results of PA-RNet under five text perturbation strategies (generalize, reverse, shuffle, insert, and truncate) at perturbation ratio $\rho = 0.9$. Lower MSE/MAE indicates better performance.

Dataset	T	Generalize		Reverse		Shuffle		Insert		Truncate		All	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	6	0.102	0.254	0.100	0.250	0.100	0.247	0.099	0.246	0.098	0.246	0.100	0.247
	8	0.122	0.261	0.122	0.264	0.123	0.264	0.125	0.264	0.122	0.263	0.124	0.262
	10	0.168	0.293	0.169	0.291	0.167	0.291	0.167	0.290	0.167	0.289	0.166	0.292
	12	0.232	0.319	0.240	0.325	0.224	0.318	0.239	0.326	0.224	0.318	0.235	0.321
	Avg	0.156	0.282	0.158	0.283	0.154	0.280	0.158	0.282	0.153	0.279	0.156	0.280
Climate	6	0.927	0.739	0.916	0.736	0.918	0.737	0.914	0.736	0.917	0.736	0.913	0.736
	8	0.960	0.760	0.955	0.758	0.954	0.757	0.954	0.757	0.954	0.757	0.954	0.757
	10	0.995	0.780	0.992	0.779	0.990	0.777	0.988	0.777	0.989	0.777	1.000	0.781
	12	1.006	0.789	1.016	0.793	1.022	0.794	1.011	0.791	1.023	0.795	1.009	0.791
	Avg	0.972	0.767	0.970	0.767	0.971	0.766	0.967	0.765	0.971	0.766	0.969	0.766
Economy	6	0.070	0.220	0.061	0.203	0.053	0.186	0.054	0.186	0.054	0.186	0.070	0.219
	8	0.094	0.249	0.084	0.241	0.084	0.243	0.084	0.244	0.085	0.245	0.128	0.296
	10	0.160	0.338	0.133	0.318	0.144	0.337	0.160	0.356	0.142	0.334	0.166	0.360
	12	0.176	0.363	0.121	0.294	0.170	0.357	0.147	0.327	0.172	0.358	0.137	0.306
	Avg	0.125	0.293	0.100	0.264	0.113	0.281	0.111	0.278	0.113	0.281	0.125	0.295
Health	12	0.874	0.634	0.876	0.635	0.871	0.632	0.875	0.635	0.880	0.636	0.935	0.655
	24	1.175	0.717	1.188	0.720	1.153	0.706	1.148	0.704	1.157	0.707	1.147	0.704
	36	1.180	0.711	1.174	0.709	1.172	0.712	1.140	0.700	1.174	0.708	1.144	0.695
	48	1.287	0.745	1.288	0.747	1.288	0.746	1.287	0.745	1.292	0.748	1.280	0.751
	Avg	1.129	0.702	1.132	0.703	1.121	0.699	1.112	0.696	1.126	0.700	1.127	0.701
Social Good	6	0.750	0.392	0.761	0.380	0.765	0.382	0.764	0.383	0.765	0.383	0.753	0.394
	8	0.814	0.425	0.814	0.418	0.825	0.428	0.819	0.420	0.825	0.424	0.819	0.428
	10	0.834	0.432	0.852	0.436	0.840	0.429	0.841	0.429	0.839	0.429	0.873	0.446
	12	0.881	0.462	0.864	0.469	0.861	0.463	0.861	0.474	0.865	0.467	0.852	0.462
	Avg	0.820	0.428	0.823	0.426	0.823	0.426	0.821	0.427	0.823	0.426	0.824	0.433
Traffic	6	0.138	0.231	0.140	0.231	0.142	0.238	0.141	0.233	0.142	0.237	0.136	0.222
	8	0.142	0.239	0.146	0.245	0.145	0.242	0.145	0.245	0.145	0.242	0.142	0.238
	10	0.145	0.241	0.147	0.239	0.147	0.241	0.148	0.243	0.148	0.242	0.143	0.242
	12	0.185	0.257	0.187	0.257	0.184	0.256	0.184	0.257	0.184	0.256	0.183	0.257
	Avg	0.153	0.242	0.155	0.243	0.154	0.244	0.154	0.245	0.155	0.244	0.151	0.240

H Comparison with Clean-Enhanced Baselines

PA-RNet is designed with textual perturbations in mind, whereas MM-TSFLib and TaTS were not originally intended for noisy textual input. To avoid attributing the observed gap solely to this difference in design, we augment both baselines with a standard text preprocessing pipeline placed upstream of the model: (1) removal of URLs and HTML tags; (2) removal of special characters (retaining only letters, digits, and common punctuation); (3) removal of extra whitespace; and (4) lowercasing. We denote the resulting variants MM-TSFLib+Clean and TaTS+Clean, which endow the baselines with a basic level of robustness to textual noise.The comparison is reported in Table 23.

Table 23: Average results under textual perturbations on benchmark textual-numerical time-series datasets. For MM-TSFLib+Clean, TaTS+Clean, and PA-RNet, results are averaged over perturbation ratios $\rho \in \{0.3, 0.5, 0.7, 0.9\}$. Bold values indicate the best results or results tied with the best-performing baseline.

Dataset	Method	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Uni-modal	0.103	0.235	0.309	0.405	0.195	0.334	0.100	0.234	0.100	0.198	0.414	0.471	0.096	0.209	0.093	0.197	0.283	0.367
	MM-TSFLib+Clean	0.103	0.236	0.247	0.351	**0.142**	**0.258**	0.101	0.232	0.100	0.198	0.345	0.422	0.094	0.205	0.092	0.196	0.233	0.331
	TaTS+Clean	0.105	0.236	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.214	0.319	0.094	**0.204**	0.092	0.195	0.158	0.282
	PA-RNet	**0.103**	**0.234**	**0.172**	**0.276**	0.150	0.276	**0.100**	**0.228**	**0.099**	**0.196**	**0.210**	**0.316**	**0.094**	0.207	**0.091**	**0.195**	**0.157**	**0.280**
Climate	Uni-modal	1.289	0.919	1.165	0.854	1.283	0.921	1.151	0.864	1.368	0.961	1.168	0.850	1.199	0.900	1.296	0.933	1.062	0.807
	MM-TSFLib+Clean	1.137	0.864	1.120	0.833	1.101	0.850	1.041	0.820	1.191	0.894	1.109	0.828	1.106	0.861	1.151	0.874	1.034	0.795
	TaTS+Clean	0.992	0.804	1.033	0.789	0.950	0.778	0.961	0.787	0.986	0.797	1.008	0.786	1.019	0.809	1.001	0.800	**0.965**	**0.765**
	PA-RNet	**0.974**	**0.798**	**1.015**	**0.782**	**0.948**	**0.777**	**0.957**	**0.786**	**0.983**	**0.795**	**0.969**	**0.773**	**1.014**	**0.806**	**0.992**	**0.796**	0.968	0.766
Economy	Uni-modal	0.083	0.227	0.566	0.642	0.113	0.281	0.077	0.216	0.018	0.108	0.572	0.712	0.016	0.098	0.019	0.107	0.129	0.276
	MM-TSFLib+Clean	0.084	0.224	0.420	0.539	0.058	0.192	0.070	0.207	0.026	0.122	0.496	0.657	0.016	0.098	0.019	0.107	0.172	0.333
	TaTS+Clean	0.026	0.128	0.171	0.359	0.016	0.102	0.037	0.145	0.010	0.085	0.309	0.513	0.011	0.085	0.011	0.086	**0.133**	0.311
	PA-RNet	**0.024**	**0.122**	**0.152**	**0.338**	**0.016**	**0.102**	**0.035**	**0.142**	**0.010**	**0.085**	**0.300**	**0.497**	**0.010**	**0.084**	**0.011**	**0.086**	0.134	**0.308**
Health	Uni-modal	1.810	0.993	1.379	0.781	1.628	0.870	1.487	0.928	1.563	0.851	1.522	0.818	1.825	0.806	1.645	0.788	1.460	0.798
	MM-TSFLib+Clean	1.714	0.953	1.327	0.760	1.538	0.840	1.393	0.879	1.463	0.818	1.394	0.780	1.617	0.782	1.441	0.753	1.301	0.757
	TaTS+Clean	1.505	0.883	1.223	0.730	1.409	0.800	1.348	0.846	1.350	0.784	1.169	0.726	1.381	**0.749**	1.260	0.725	**1.135**	0.706
	PA-RNet	**1.488**	**0.877**	**1.206**	**0.727**	**1.409**	**0.799**	**1.333**	**0.839**	**1.347**	**0.782**	**1.157**	**0.720**	**1.371**	0.753	**1.249**	**0.722**	1.140	**0.705**
Social Good	Uni-modal	1.128	**0.593**	0.854	0.471	1.041	0.574	1.180	**0.527**	1.118	0.524	0.805	0.422	1.164	0.593	1.052	0.517	0.819	0.427
	MM-TSFLib+Clean	1.085	0.602	0.844	0.476	1.023	0.578	1.130	0.540	1.043	0.590	**0.801**	0.429	**1.052**	**0.538**	**1.037**	0.543	0.836	0.443
	TaTS+Clean	**1.078**	0.605	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.823	0.420	1.117	0.666	1.044	0.519	0.829	**0.426**
	PA-RNet	1.083	0.603	**0.842**	**0.461**	**1.016**	**0.569**	**1.067**	0.559	**1.033**	**0.515**	0.804	**0.419**	1.172	0.602	1.041	**0.507**	**0.819**	0.428
Traffic	Uni-modal	0.194	0.273	0.201	0.318	0.325	0.438	0.203	0.274	0.254	0.330	0.163	0.295	0.194	0.242	0.193	0.242	0.163	0.273
	MM-TSFLib+Clean	0.186	0.270	0.194	0.312	0.245	0.367	0.188	0.259	0.238	0.318	0.170	0.302	0.190	0.246	0.187	0.245	0.164	0.273
	TaTS+Clean	0.164	0.225	0.170	0.285	0.197	0.311	0.171	**0.228**	0.183	0.258	**0.152**	0.272	0.182	0.223	0.176	0.219	**0.151**	0.256
	PA-RNet	**0.163**	**0.225**	**0.169**	**0.283**	**0.196**	**0.310**	**0.171**	0.229	**0.183**	**0.257**	0.153	**0.261**	**0.178**	**0.221**	**0.175**	**0.219**	0.154	**0.247**
Avg. Rank ↓		**PA-RNet**: **1.26** TaTS: 1.99 MM-TSFLib: 2.94 Uni-modal: 3.51																	

Table 24: Complete forecasting results under textual perturbation at $\rho = 0.3$. Results are reported for MM-TSFLib+Clean, TaTS+Clean. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	MM-TSFLib+Clean	6	0.076	0.198	0.139	0.262	0.095	0.209	0.073	0.194	0.067	0.161	0.211	0.330	0.063	0.173	0.061	0.163	0.163	0.281
		8	0.093	0.223	0.243	0.353	0.132	0.257	0.091	0.219	0.085	0.184	0.266	0.369	0.078	0.186	0.078	0.182	0.213	0.323
		10	0.108	0.249	0.273	0.373	0.153	0.275	0.108	0.247	0.110	0.211	0.378	0.449	0.103	0.220	0.098	0.204	0.254	0.347
		12	0.133	0.273	0.335	0.409	0.187	0.290	0.134	0.268	0.139	0.236	0.520	0.538	0.131	0.241	0.131	0.235	0.302	0.374
		Avg	0.103	0.236	0.248	0.349	0.142	0.258	0.101	0.232	0.100	0.198	0.344	0.422	0.094	0.205	0.092	0.196	0.233	0.331
	TaTS+Clean	6	0.073	0.193	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.120	0.255	0.065	0.177	0.060	0.161	0.096	0.249
		8	0.095	0.222	0.155	0.275	0.133	0.264	0.089	0.222	0.083	0.181	0.163	0.289	0.080	0.189	0.078	0.181	0.125	0.267
		10	0.109	0.253	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.229	0.325	0.102	0.216	0.100	0.204	0.177	0.290
		12	0.137	0.276	0.255	0.339	0.194	0.308	0.131	0.272	0.139	0.236	0.342	0.405	0.130	0.239	0.131	0.235	0.233	0.323
		Avg	0.104	0.236	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.214	0.319	0.094	0.205	0.092	0.195	0.158	0.282
Climate	MM-TSFLib+Clean	6	1.119	0.855	1.163	0.840	1.108	0.855	1.001	0.801	1.181	0.880	1.123	0.829	1.059	0.849	1.129	0.871	1.036	0.789
		8	1.154	0.869	1.110	0.828	1.088	0.847	1.029	0.814	1.189	0.896	1.149	0.847	1.138	0.874	1.146	0.871	1.043	0.797
		10	1.137	0.861	1.112	0.834	1.095	0.848	1.055	0.830	1.205	0.902	1.101	0.826	1.111	0.860	1.167	0.877	1.023	0.793
		12	1.138	0.868	1.108	0.837	1.105	0.847	1.079	0.839	1.189	0.896	1.141	0.842	1.117	0.864	1.152	0.875	1.033	0.800
		Avg	1.137	0.863	1.123	0.835	1.099	0.849	1.041	0.821	1.191	0.894	1.129	0.836	1.106	0.862	1.149	0.873	1.034	0.795
	TaTS+Clean	6	1.019	0.819	1.027	0.778	0.929	0.771	0.910	0.764	0.969	0.784	0.994	0.775	0.985	0.794	0.974	0.793	0.914	0.740
		8	0.982	0.798	1.020	0.782	0.942	0.776	0.939	0.774	0.974	0.793	0.989	0.779	1.018	0.807	0.986	0.788	0.973	0.769
		10	0.996	0.804	1.029	0.790	0.963	0.783	0.994	0.799	0.997	0.803	0.997	0.783	1.020	0.808	1.023	0.808	0.996	0.777
		12	0.965	0.791	1.054	0.804	0.967	0.781	0.992	0.812	1.002	0.806	1.051	0.804	1.047	0.823	1.021	0.809	0.975	0.775
		Avg	0.990	0.803	1.033	0.789	0.950	0.778	0.959	0.787	0.986	0.797	1.008	0.785	1.018	0.808	1.001	0.800	0.965	0.765
Economy	MM-TSFLib+Clean	6	0.090	0.235	0.177	0.369	0.053	0.186	0.081	0.220	0.034	0.141	0.413	0.591	0.016	0.096	0.020	0.109	0.127	0.272
		8	0.081	0.222	0.242	0.424	0.067	0.205	0.070	0.205	0.025	0.119	0.431	0.618	0.016	0.096	0.019	0.108	0.235	0.391
		10	0.075	0.213	0.443	0.618	0.063	0.204	0.061	0.195	0.025	0.119	0.621	0.744	0.016	0.100	0.018	0.105	0.196	0.360
		12	0.077	0.212	0.555	0.703	0.057	0.190	0.069	0.208	0.032	0.135	0.530	0.683	0.016	0.098	0.018	0.107	0.142	0.310
		Avg	0.081	0.220	0.354	0.529	0.060	0.196	0.070	0.207	0.029	0.129	0.499	0.659	0.016	0.098	0.019	0.107	0.175	0.333
	TaTS+Clean	6	0.025	0.124	0.089	0.253	0.017	0.106	0.040	0.153	0.011	0.087	0.202	0.407	0.011	0.085	0.011	0.086	0.064	0.208
		8	0.031	0.140	0.114	0.293	0.016	0.103	0.037	0.145	0.010	0.085	0.296	0.497	0.011	0.085	0.011	0.087	0.100	0.267
		10	0.026	0.125	0.237	0.440	0.015	0.099	0.030	0.132	0.010	0.084	0.352	0.562	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.025	0.125	0.234	0.436	0.015	0.099	0.039	0.150	0.010	0.083	0.387	0.586	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.027	0.129	0.169	0.356	0.016	0.102	0.037	0.145	0.010	0.085	0.309	0.513	0.011	0.085	0.011	0.086	0.133	0.311
Health	MM-TSFLib+Clean	12	1.546	0.924	1.146	0.734	1.412	0.807	1.140	0.782	1.185	0.730	1.148	0.728	0.990	0.620	0.878	0.602	1.178	0.768
		24	1.802	0.998	1.384	0.775	1.535	0.825	1.472	0.926	1.456	0.812	1.407	0.776	1.618	0.765	1.365	0.725	1.279	0.704
		36	1.716	0.956	1.362	0.757	1.578	0.852	1.476	0.907	1.557	0.844	1.467	0.800	1.911	0.849	1.683	0.814	1.387	0.779
		48	1.818	0.968	1.480	0.800	1.630	0.876	1.509	0.910	1.654	0.885	1.552	0.825	1.941	0.887	1.856	0.869	1.408	0.779
		Avg	1.721	0.962	1.343	0.767	1.539	0.840	1.399	0.881	1.463	0.818	1.394	0.782	1.615	0.780	1.446	0.753	1.313	0.758
	TaTS+Clean	12	1.332	0.838	1.001	0.683	1.282	0.765	1.125	0.775	1.123	0.711	0.966	0.665	0.901	0.615	0.795	0.594	0.913	0.641
		24	1.500	0.881	1.252	0.740	1.399	0.790	1.385	0.864	1.362	0.786	1.184	0.726	1.315	0.721	1.198	0.707	1.126	0.709
		36	1.531	0.878	1.227	0.718	1.449	0.809	1.423	0.867	1.421	0.801	1.211	0.732	1.580	0.806	1.453	0.777	1.190	0.717
		48	1.566	0.884	1.349	0.764	1.504	0.834	1.476	0.889	1.495	0.837	1.305	0.778	1.727	0.853	1.592	0.822	1.294	0.751
		Avg	1.482	0.870	1.207	0.726	1.409	0.800	1.352	0.849	1.350	0.784	1.166	0.725	1.381	0.749	1.260	0.725	1.131	0.705
Social Good	MM-TSFLib+Clean	6	0.995	0.572	0.755	0.428	0.946	0.536	0.919	0.469	0.956	0.569	0.740	0.372	1.071	0.484	0.970	0.546	0.745	0.413
		8	1.044	0.582	0.841	0.480	0.991	0.559	1.112	0.518	1.021	0.570	0.788	0.427	1.048	0.551	1.006	0.543	0.856	0.480
		10	1.097	0.600	0.872	0.487	1.046	0.592	1.205	0.568	1.077	0.599	0.836	0.450	1.161	0.533	1.009	0.506	0.894	0.501
		12	1.193	0.654	0.907	0.514	1.113	0.627	1.280	0.599	1.131	0.624	0.843	0.475	1.107	0.566	1.120	0.566	0.874	0.470
		Avg	1.082	0.602	0.844	0.477	1.024	0.579	1.129	0.539	1.046	0.590	0.802	0.431	1.097	0.534	1.026	0.540	0.842	0.466
	TaTS+Clean	6	0.962	0.537	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.752	0.384	1.057	0.649	0.969	0.532	0.777	0.399
		8	1.070	0.600	0.819	0.462	1.030	0.575	1.056	0.557	1.013	0.509	0.815	0.414	1.113	0.663	0.929	0.468	0.841	0.424
		10	1.093	0.610	0.884	0.496	1.044	0.585	1.131	0.604	1.108	0.556	0.872	0.439	1.123	0.656	1.057	0.531	0.857	0.429
		12	1.170	0.653	0.924	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.846	0.440	1.169	0.680	1.221	0.546	0.854	0.456
		Avg	1.074	0.600	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.821	0.419	1.116	0.662	1.044	0.519	0.832	0.427
Traffic	MM-TSFLib+Clean	6	0.162	0.253	0.180	0.306	0.251	0.381	0.165	0.242	0.239	0.338	0.163	0.307	0.167	0.238	0.160	0.231	0.148	0.260
		8	0.179	0.275	0.190	0.320	0.245	0.369	0.169	0.244	0.223	0.307	0.162	0.299	0.182	0.243	0.169	0.235	0.157	0.274
		10	0.171	0.267	0.190	0.311	0.221	0.347	0.173	0.246	0.220	0.302	0.161	0.296	0.186	0.247	0.180	0.240	0.157	0.274
		12	0.231	0.289	0.218	0.313	0.259	0.365	0.241	0.294	0.263	0.318	0.201	0.319	0.243	0.279	0.238	0.272	0.194	0.281
		Avg	0.186	0.271	0.195	0.313	0.244	0.366	0.187	0.257	0.236	0.316	0.172	0.305	0.194	0.252	0.187	0.245	0.164	0.272
	TaTS+Clean	6	0.144	0.210	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.137	0.250	0.159	0.210	0.149	0.206	0.138	0.244
		8	0.146	0.212	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.144	0.269	0.168	0.215	0.161	0.211	0.142	0.254
		10	0.151	0.221	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.146	0.270	0.173	0.219	0.169	0.217	0.144	0.255
		12	0.211	0.252	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.182	0.296	0.230	0.246	0.226	0.242	0.180	0.270
		Avg	0.163	0.224	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.152	0.271	0.183	0.223	0.176	0.219	0.151	0.256

Table 25: Complete forecasting results under textual perturbation at $\rho = 0.5$. Results are reported for MM-TSFLib+Clean, TaTS+Clean. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	MM-TSFLib+Clean	6	0.076	0.198	0.139	0.263	0.095	0.209	0.073	0.194	0.067	0.161	0.206	0.322	0.063	0.173	0.061	0.163	0.159	0.278
		8	0.093	0.223	0.247	0.360	0.132	0.257	0.091	0.219	0.085	0.184	0.268	0.371	0.078	0.186	0.078	0.182	0.219	0.325
		10	0.108	0.249	0.272	0.373	0.154	0.275	0.108	0.247	0.110	0.211	0.389	0.458	0.103	0.220	0.098	0.204	0.250	0.344
		12	0.133	0.273	0.335	0.410	0.186	0.289	0.134	0.268	0.139	0.236	0.515	0.536	0.131	0.241	0.131	0.235	0.300	0.372
		Avg	0.103	0.236	0.248	0.352	0.142	0.258	0.101	0.232	0.100	0.198	0.345	0.422	0.094	0.205	0.092	0.196	0.232	0.330
	TaTS+Clean	6	0.072	0.188	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.122	0.258	0.064	0.174	0.060	0.161	0.096	0.249
		8	0.098	0.233	0.155	0.275	0.133	0.264	0.089	0.222	0.083	0.181	0.164	0.290	0.080	0.188	0.078	0.181	0.125	0.267
		10	0.110	0.252	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.231	0.328	0.101	0.212	0.100	0.204	0.177	0.290
		12	0.137	0.275	0.255	0.339	0.194	0.308	0.131	0.272	0.139	0.236	0.342	0.404	0.130	0.239	0.131	0.235	0.233	0.323
		Avg	0.104	0.237	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.215	0.320	0.094	0.203	0.092	0.195	0.158	0.282
Climate	MM-TSFLib+Clean	6	1.128	0.864	1.130	0.827	1.108	0.855	1.003	0.801	1.181	0.880	1.118	0.828	1.058	0.849	1.129	0.870	1.037	0.789
		8	1.152	0.866	1.108	0.827	1.094	0.849	1.029	0.814	1.190	0.896	1.098	0.823	1.137	0.873	1.146	0.871	1.044	0.797
		10	1.133	0.860	1.104	0.831	1.099	0.849	1.057	0.830	1.204	0.902	1.084	0.819	1.111	0.860	1.175	0.880	1.025	0.795
		12	1.159	0.879	1.111	0.838	1.106	0.847	1.072	0.836	1.189	0.896	1.105	0.831	1.117	0.863	1.157	0.876	1.029	0.799
		Avg	1.143	0.867	1.113	0.831	1.102	0.850	1.040	0.820	1.191	0.894	1.101	0.825	1.106	0.861	1.152	0.874	1.034	0.795
	TaTS+Clean	6	1.015	0.816	1.027	0.778	0.929	0.771	0.910	0.764	0.969	0.784	0.995	0.775	0.988	0.798	0.974	0.793	0.914	0.740
		8	0.990	0.805	1.020	0.782	0.942	0.776	0.940	0.774	0.974	0.793	0.993	0.780	1.019	0.807	0.986	0.788	0.973	0.769
		10	0.995	0.804	1.029	0.790	0.963	0.783	0.996	0.801	0.997	0.803	0.985	0.781	1.021	0.808	1.023	0.808	0.996	0.777
		12	0.941	0.779	1.054	0.804	0.967	0.781	1.006	0.811	1.002	0.806	1.023	0.795	1.050	0.825	1.021	0.809	0.975	0.775
		Avg	0.985	0.801	1.033	0.789	0.950	0.778	0.963	0.788	0.986	0.797	0.999	0.783	1.019	0.810	1.001	0.800	0.965	0.765
Economy	MM-TSFLib+Clean	6	0.092	0.238	0.180	0.367	0.052	0.184	0.081	0.220	0.028	0.128	0.404	0.592	0.016	0.096	0.020	0.109	0.127	0.272
		8	0.080	0.220	0.262	0.446	0.069	0.213	0.070	0.205	0.025	0.122	0.443	0.621	0.016	0.096	0.019	0.108	0.235	0.391
		10	0.076	0.216	0.350	0.524	0.065	0.211	0.061	0.195	0.025	0.119	0.612	0.740	0.016	0.100	0.018	0.105	0.196	0.360
		12	0.081	0.217	0.498	0.626	0.058	0.193	0.069	0.208	0.031	0.133	0.542	0.687	0.016	0.098	0.018	0.107	0.142	0.310
		Avg	0.082	0.223	0.323	0.491	0.061	0.200	0.070	0.207	0.027	0.126	0.500	0.660	0.016	0.098	0.019	0.107	0.175	0.333
	TaTS+Clean	6	0.026	0.128	0.093	0.259	0.017	0.106	0.040	0.153	0.011	0.087	0.201	0.411	0.011	0.087	0.011	0.086	0.064	0.208
		8	0.028	0.136	0.135	0.327	0.016	0.103	0.037	0.145	0.010	0.085	0.298	0.499	0.010	0.085	0.011	0.087	0.100	0.266
		10	0.025	0.125	0.226	0.421	0.015	0.099	0.030	0.132	0.010	0.084	0.346	0.557	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.022	0.119	0.213	0.412	0.015	0.099	0.038	0.150	0.010	0.083	0.386	0.585	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.025	0.127	0.167	0.355	0.016	0.102	0.036	0.145	0.010	0.085	0.308	0.513	0.010	0.085	0.011	0.086	0.133	0.311
Health	MM-TSFLib+Clean	12	1.469	0.889	1.061	0.685	1.408	0.804	1.117	0.772	1.186	0.731	1.096	0.713	0.997	0.624	0.889	0.609	1.169	0.765
		24	1.816	0.990	1.371	0.778	1.534	0.824	1.432	0.901	1.452	0.813	1.426	0.780	1.621	0.767	1.357	0.722	1.285	0.707
		36	1.802	0.972	1.359	0.754	1.580	0.852	1.476	0.911	1.562	0.846	1.463	0.786	1.875	0.847	1.655	0.812	1.322	0.773
		48	1.806	0.961	1.500	0.800	1.630	0.878	1.511	0.912	1.653	0.884	1.563	0.827	1.957	0.891	1.816	0.865	1.429	0.784
		Avg	1.723	0.953	1.323	0.754	1.538	0.840	1.384	0.874	1.463	0.819	1.387	0.777	1.613	0.782	1.429	0.752	1.301	0.757
	TaTS+Clean	12	1.403	0.882	1.136	0.726	1.282	0.765	1.109	0.762	1.123	0.711	0.972	0.666	0.891	0.605	0.795	0.594	0.913	0.641
		24	1.562	0.914	1.198	0.715	1.399	0.790	1.370	0.857	1.362	0.786	1.186	0.726	1.323	0.719	1.198	0.707	1.126	0.709
		36	1.611	0.905	1.229	0.729	1.449	0.809	1.423	0.867	1.421	0.801	1.210	0.733	1.595	0.813	1.453	0.777	1.190	0.717
		48	1.621	0.906	1.354	0.767	1.504	0.834	1.475	0.889	1.495	0.837	1.307	0.777	1.692	0.853	1.592	0.822	1.294	0.751
		Avg	1.549	0.902	1.229	0.734	1.409	0.800	1.344	0.844	1.350	0.784	1.169	0.726	1.375	0.747	1.260	0.725	1.131	0.705
Social Good	MM-TSFLib+Clean	6	0.981	0.553	0.754	0.428	0.945	0.537	0.927	0.476	0.957	0.539	0.736	0.381	0.918	0.466	0.991	0.543	0.772	0.403
		8	1.052	0.587	0.836	0.477	0.991	0.559	1.113	0.519	1.010	0.580	0.788	0.416	1.017	0.554	1.018	0.549	0.810	0.419
		10	1.114	0.609	0.871	0.486	1.044	0.589	1.191	0.569	1.077	0.602	0.831	0.451	1.079	0.562	1.042	0.516	0.877	0.457
		12	1.210	0.680	0.909	0.509	1.112	0.627	1.285	0.599	1.130	0.626	0.835	0.461	1.144	0.593	1.112	0.563	0.872	0.465
		Avg	1.089	0.607	0.843	0.475	1.023	0.578	1.129	0.541	1.043	0.587	0.798	0.427	1.040	0.544	1.041	0.543	0.833	0.436
	TaTS+Clean	6	0.962	0.541	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.745	0.371	1.054	0.645	0.969	0.532	0.777	0.399
		8	1.058	0.601	0.820	0.463	1.030	0.575	1.056	0.557	1.013	0.509	0.805	0.411	1.102	0.656	0.929	0.468	0.817	0.413
		10	1.127	0.641	0.884	0.496	1.044	0.585	1.131	0.603	1.108	0.556	0.884	0.447	1.122	0.665	1.057	0.531	0.856	0.429
		12	1.173	0.648	0.924	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.851	0.449	1.189	0.705	1.221	0.546	0.855	0.456
		Avg	1.080	0.608	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.821	0.420	1.117	0.668	1.044	0.519	0.826	0.424
Traffic	MM-TSFLib+Clean	6	0.159	0.247	0.180	0.306	0.251	0.381	0.165	0.245	0.239	0.339	0.160	0.300	0.169	0.240	0.160	0.231	0.148	0.260
		8	0.171	0.260	0.189	0.317	0.243	0.367	0.168	0.244	0.221	0.304	0.157	0.291	0.177	0.237	0.169	0.235	0.157	0.275
		10	0.177	0.274	0.190	0.311	0.226	0.352	0.176	0.253	0.223	0.304	0.161	0.295	0.182	0.240	0.180	0.241	0.155	0.270
		12	0.230	0.291	0.218	0.312	0.258	0.364	0.240	0.293	0.264	0.318	0.200	0.315	0.237	0.270	0.238	0.273	0.194	0.281
		Avg	0.184	0.268	0.194	0.312	0.245	0.366	0.187	0.259	0.237	0.316	0.169	0.300	0.191	0.247	0.187	0.245	0.163	0.272
	TaTS+Clean	6	0.139	0.206	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.139	0.254	0.159	0.210	0.149	0.206	0.138	0.244
		8	0.148	0.214	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.143	0.267	0.169	0.216	0.161	0.211	0.142	0.254
		10	0.153	0.226	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.145	0.267	0.173	0.219	0.169	0.217	0.144	0.255
		12	0.213	0.256	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.180	0.290	0.228	0.245	0.226	0.242	0.180	0.270
		Avg	0.163	0.226	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.152	0.270	0.182	0.223	0.176	0.219	0.151	0.256

Table 26: Complete forecasting results under textual perturbation at $\rho = 0.7$. Results are reported for MM-TSFLib+Clean, TaTS+Clean. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	MM-TSFLib+Clean	6	0.076	0.198	0.138	0.263	0.095	0.209	0.073	0.194	0.067	0.161	0.204	0.321	0.063	0.173	0.061	0.163	0.163	0.280
		8	0.093	0.223	0.241	0.357	0.132	0.257	0.091	0.219	0.085	0.184	0.261	0.363	0.078	0.186	0.078	0.182	0.215	0.323
		10	0.108	0.249	0.273	0.373	0.154	0.276	0.108	0.247	0.110	0.211	0.388	0.459	0.103	0.220	0.098	0.204	0.252	0.346
		12	0.133	0.273	0.334	0.410	0.186	0.290	0.134	0.268	0.139	0.236	0.522	0.539	0.131	0.241	0.131	0.235	0.305	0.378
		Avg	0.103	0.236	0.247	0.351	0.142	0.258	0.101	0.232	0.100	0.198	0.344	0.421	0.094	0.205	0.092	0.196	0.234	0.332
	TaTS+Clean	6	0.073	0.191	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.120	0.253	0.064	0.174	0.060	0.161	0.096	0.248
		8	0.096	0.227	0.155	0.275	0.133	0.264	0.089	0.222	0.083	0.181	0.158	0.280	0.080	0.188	0.078	0.181	0.125	0.267
		10	0.110	0.250	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.230	0.327	0.101	0.213	0.100	0.204	0.177	0.290
		12	0.139	0.281	0.255	0.339	0.194	0.308	0.131	0.272	0.139	0.236	0.345	0.408	0.132	0.241	0.131	0.235	0.233	0.322
		Avg	0.105	0.237	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.213	0.317	0.094	0.204	0.092	0.195	0.158	0.282
Climate	MM-TSFLib+Clean	6	1.103	0.853	1.163	0.839	1.116	0.858	1.001	0.801	1.181	0.880	1.138	0.837	1.058	0.848	1.127	0.870	1.037	0.789
		8	1.130	0.862	1.108	0.827	1.087	0.846	1.041	0.817	1.190	0.896	1.096	0.822	1.137	0.873	1.147	0.870	1.044	0.797
		10	1.141	0.861	1.103	0.831	1.103	0.850	1.056	0.832	1.204	0.901	1.087	0.820	1.111	0.860	1.174	0.879	1.025	0.794
		12	1.144	0.867	1.106	0.836	1.106	0.848	1.073	0.836	1.190	0.897	1.101	0.829	1.117	0.863	1.155	0.876	1.030	0.799
		Avg	1.130	0.861	1.120	0.833	1.103	0.850	1.043	0.821	1.191	0.894	1.106	0.827	1.106	0.861	1.151	0.874	1.034	0.795
	TaTS+Clean	6	1.007	0.808	1.027	0.778	0.929	0.771	0.910	0.764	0.969	0.784	0.992	0.774	0.990	0.799	0.974	0.793	0.913	0.740
		8	0.990	0.802	1.020	0.782	0.942	0.776	0.940	0.774	0.974	0.793	0.994	0.781	1.019	0.808	0.986	0.788	0.972	0.768
		10	1.001	0.806	1.029	0.790	0.963	0.783	0.991	0.797	0.997	0.803	0.997	0.782	1.022	0.809	1.023	0.808	0.995	0.777
		12	0.993	0.805	1.054	0.804	0.967	0.781	0.997	0.812	1.002	0.806	1.049	0.805	1.049	0.824	1.021	0.809	0.974	0.775
		Avg	0.998	0.805	1.033	0.789	0.950	0.778	0.960	0.787	0.986	0.797	1.008	0.786	1.020	0.810	1.001	0.800	0.964	0.765
Economy	MM-TSFLib+Clean	6	0.087	0.231	0.424	0.540	0.049	0.180	0.081	0.220	0.034	0.140	0.419	0.601	0.016	0.096	0.020	0.109	0.127	0.272
		8	0.085	0.228	0.292	0.445	0.064	0.203	0.070	0.205	0.025	0.121	0.445	0.627	0.016	0.096	0.019	0.108	0.235	0.391
		10	0.080	0.217	0.378	0.560	0.062	0.199	0.061	0.195	0.025	0.119	0.621	0.742	0.016	0.100	0.018	0.105	0.196	0.360
		12	0.081	0.215	0.457	0.626	0.057	0.190	0.069	0.208	0.037	0.147	0.529	0.677	0.016	0.098	0.018	0.107	0.142	0.310
		Avg	0.083	0.223	0.388	0.543	0.058	0.193	0.070	0.207	0.030	0.132	0.504	0.662	0.016	0.098	0.019	0.107	0.175	0.333
	TaTS+Clean	6	0.026	0.129	0.090	0.255	0.017	0.106	0.040	0.153	0.011	0.087	0.198	0.405	0.011	0.085	0.011	0.086	0.064	0.208
		8	0.030	0.138	0.111	0.286	0.016	0.103	0.037	0.145	0.010	0.085	0.297	0.498	0.011	0.085	0.011	0.087	0.100	0.267
		10	0.026	0.127	0.229	0.425	0.015	0.099	0.030	0.132	0.010	0.084	0.348	0.557	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.022	0.119	0.245	0.453	0.015	0.099	0.039	0.150	0.010	0.083	0.387	0.586	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.026	0.128	0.169	0.355	0.016	0.102	0.037	0.145	0.010	0.085	0.308	0.512	0.011	0.085	0.011	0.086	0.133	0.311
Health	MM-TSFLib+Clean	12	1.477	0.907	1.206	0.753	1.406	0.804	1.151	0.786	1.185	0.730	1.109	0.721	0.996	0.624	0.904	0.613	1.175	0.766
		24	1.730	0.958	1.327	0.758	1.535	0.824	1.446	0.913	1.456	0.812	1.412	0.775	1.620	0.766	1.377	0.727	1.267	0.704
		36	1.751	0.963	1.319	0.742	1.579	0.852	1.474	0.907	1.561	0.844	1.477	0.799	1.891	0.848	1.641	0.807	1.316	0.770
		48	1.842	0.974	1.500	0.806	1.628	0.877	1.501	0.911	1.654	0.885	1.584	0.830	1.987	0.890	1.843	0.866	1.422	0.782
		Avg	1.700	0.950	1.338	0.765	1.537	0.839	1.393	0.879	1.464	0.818	1.396	0.781	1.624	0.782	1.441	0.753	1.295	0.756
	TaTS+Clean	12	1.346	0.848	1.118	0.717	1.282	0.765	1.143	0.779	1.123	0.711	1.001	0.686	0.902	0.618	0.795	0.594	0.973	0.658
		24	1.492	0.892	1.289	0.740	1.399	0.790	1.388	0.868	1.362	0.786	1.183	0.725	1.304	0.720	1.198	0.707	1.125	0.709
		36	1.562	0.887	1.265	0.727	1.449	0.809	1.423	0.867	1.421	0.801	1.213	0.733	1.590	0.808	1.453	0.777	1.190	0.717
		48	1.631	0.909	1.343	0.764	1.504	0.834	1.476	0.889	1.495	0.837	1.305	0.776	1.727	0.854	1.592	0.822	1.294	0.751
		Avg	1.508	0.884	1.254	0.737	1.409	0.800	1.358	0.851	1.350	0.784	1.176	0.730	1.381	0.750	1.260	0.725	1.146	0.709
Social Good	MM-TSFLib+Clean	6	0.991	0.564	0.755	0.429	0.945	0.536	0.916	0.473	0.944	0.542	0.739	0.384	0.877	0.466	0.993	0.547	0.776	0.400
		8	1.051	0.587	0.838	0.478	0.986	0.560	1.114	0.518	1.010	0.580	0.786	0.421	0.982	0.523	1.010	0.549	0.831	0.424
		10	1.092	0.593	0.874	0.488	1.045	0.589	1.200	0.567	1.078	0.602	0.858	0.454	1.053	0.548	1.029	0.519	0.856	0.445
		12	1.196	0.657	0.910	0.511	1.112	0.626	1.282	0.599	1.129	0.626	0.834	0.458	1.110	0.579	1.108	0.561	0.874	0.469
		Avg	1.083	0.600	0.844	0.477	1.022	0.578	1.128	0.539	1.040	0.587	0.804	0.429	1.006	0.529	1.035	0.544	0.834	0.435
	TaTS+Clean	6	0.957	0.533	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.762	0.382	1.055	0.641	0.969	0.532	0.777	0.399
		8	1.065	0.601	0.820	0.463	1.030	0.575	1.056	0.557	1.013	0.509	0.801	0.407	1.098	0.669	0.929	0.468	0.819	0.414
		10	1.115	0.629	0.884	0.496	1.044	0.585	1.131	0.603	1.108	0.556	0.877	0.445	1.140	0.669	1.057	0.531	0.856	0.429
		12	1.161	0.649	0.924	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.844	0.441	1.180	0.697	1.221	0.546	0.856	0.453
		Avg	1.075	0.603	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.821	0.419	1.118	0.669	1.044	0.519	0.827	0.424
Traffic	MM-TSFLib+Clean	6	0.161	0.251	0.180	0.306	0.251	0.381	0.165	0.245	0.237	0.336	0.160	0.299	0.160	0.231	0.160	0.230	0.148	0.260
		8	0.164	0.247	0.189	0.317	0.242	0.367	0.169	0.245	0.223	0.306	0.157	0.292	0.174	0.234	0.169	0.235	0.158	0.275
		10	0.179	0.273	0.190	0.311	0.226	0.353	0.175	0.250	0.223	0.304	0.159	0.291	0.180	0.238	0.180	0.240	0.157	0.274
		12	0.242	0.299	0.218	0.313	0.261	0.367	0.243	0.296	0.270	0.327	0.198	0.312	0.235	0.267	0.238	0.273	0.194	0.281
		Avg	0.187	0.268	0.194	0.312	0.245	0.367	0.188	0.259	0.238	0.318	0.168	0.299	0.187	0.243	0.187	0.245	0.164	0.273
	TaTS+Clean	6	0.145	0.211	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.140	0.258	0.159	0.210	0.149	0.206	0.138	0.244
		8	0.147	0.213	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.142	0.265	0.169	0.216	0.161	0.211	0.142	0.254
		10	0.154	0.221	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.144	0.264	0.173	0.219	0.169	0.217	0.144	0.255
		12	0.215	0.254	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.182	0.296	0.228	0.246	0.226	0.242	0.180	0.270
		Avg	0.165	0.225	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.152	0.271	0.182	0.223	0.176	0.219	0.151	0.256

Table 27: Complete forecasting results under textual perturbation at $\rho = 0.9$. Results are reported for MM-TSFLib+Clean, TaTS+Clean. Lower MSE/MAE indicates better performance.

Dataset	Method	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
			MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	MM-TSFLib+Clean	6	0.076	0.198	0.138	0.263	0.095	0.209	0.073	0.194	0.067	0.161	0.211	0.329	0.063	0.173	0.061	0.163	0.162	0.278
		8	0.093	0.223	0.241	0.361	0.132	0.257	0.091	0.219	0.085	0.184	0.266	0.369	0.078	0.186	0.078	0.182	0.218	0.323
		10	0.108	0.245	0.272	0.371	0.154	0.276	0.108	0.247	0.110	0.211	0.386	0.455	0.103	0.220	0.098	0.204	0.251	0.345
		12	0.133	0.273	0.334	0.408	0.189	0.293	0.134	0.268	0.139	0.236	0.526	0.542	0.131	0.241	0.131	0.235	0.306	0.378
		Avg	0.103	0.235	0.246	0.351	0.143	0.259	0.101	0.232	0.100	0.198	0.347	0.424	0.094	0.205	0.092	0.196	0.234	0.331
	TaTS+Clean	6	0.074	0.187	0.099	0.233	0.122	0.253	0.076	0.198	0.066	0.160	0.120	0.258	0.065	0.178	0.060	0.161	0.096	0.249
		8	0.096	0.223	0.155	0.275	0.133	0.264	0.089	0.222	0.083	0.181	0.163	0.287	0.079	0.189	0.078	0.181	0.125	0.267
		10	0.110	0.252	0.198	0.299	0.159	0.283	0.108	0.254	0.107	0.208	0.229	0.326	0.101	0.212	0.100	0.204	0.177	0.290
		12	0.139	0.275	0.255	0.339	0.194	0.308	0.131	0.272	0.139	0.236	0.343	0.404	0.131	0.241	0.131	0.235	0.233	0.322
		Avg	0.105	0.234	0.177	0.287	0.152	0.277	0.101	0.237	0.099	0.196	0.214	0.319	0.094	0.205	0.092	0.195	0.158	0.282
Climate	MM-TSFLib+Clean	6	1.136	0.863	1.163	0.839	1.115	0.857	0.990	0.795	1.181	0.880	1.119	0.828	1.059	0.849	1.127	0.869	1.037	0.789
		8	1.115	0.853	1.108	0.827	1.088	0.847	1.029	0.814	1.190	0.896	1.099	0.822	1.137	0.874	1.146	0.870	1.046	0.798
		10	1.145	0.864	1.111	0.833	1.100	0.850	1.059	0.829	1.204	0.902	1.089	0.820	1.109	0.859	1.175	0.880	1.024	0.793
		12	1.148	0.873	1.113	0.839	1.101	0.845	1.072	0.836	1.189	0.896	1.096	0.827	1.115	0.863	1.156	0.877	1.033	0.800
		Avg	1.136	0.863	1.124	0.834	1.101	0.850	1.038	0.818	1.191	0.894	1.101	0.824	1.105	0.861	1.151	0.874	1.035	0.795
	TaTS+Clean	6	1.026	0.821	1.027	0.778	0.929	0.771	0.910	0.764	0.969	0.784	1.028	0.788	0.987	0.797	0.974	0.793	0.913	0.740
		8	0.994	0.807	1.020	0.782	0.942	0.776	0.940	0.774	0.974	0.793	0.992	0.780	1.020	0.808	0.986	0.788	0.972	0.768
		10	0.997	0.804	1.029	0.790	0.963	0.783	0.997	0.800	0.997	0.803	1.007	0.784	1.021	0.809	1.023	0.808	0.995	0.777
		12	0.966	0.791	1.054	0.804	0.967	0.781	0.992	0.807	1.002	0.806	1.046	0.803	1.047	0.822	1.021	0.809	0.974	0.775
		Avg	0.996	0.806	1.033	0.789	0.950	0.778	0.960	0.786	0.986	0.797	1.018	0.789	1.019	0.809	1.001	0.800	0.964	0.765
Economy	MM-TSFLib+Clean	6	0.088	0.233	0.921	0.594	0.048	0.178	0.081	0.220	0.028	0.128	0.418	0.595	0.016	0.096	0.020	0.109	0.127	0.272
		8	0.083	0.225	0.202	0.391	0.067	0.210	0.070	0.205	0.030	0.132	0.450	0.632	0.016	0.096	0.019	0.108	0.235	0.391
		10	0.082	0.220	0.529	0.666	0.062	0.203	0.061	0.195	0.025	0.117	0.610	0.736	0.016	0.100	0.018	0.105	0.196	0.360
		12	0.080	0.216	0.498	0.651	0.061	0.197	0.069	0.208	0.024	0.116	0.519	0.670	0.016	0.098	0.018	0.107	0.142	0.310
		Avg	0.083	0.224	0.538	0.576	0.060	0.197	0.070	0.207	0.027	0.123	0.499	0.658	0.016	0.098	0.019	0.107	0.175	0.333
	TaTS+Clean	6	0.027	0.129	0.092	0.259	0.017	0.106	0.040	0.153	0.011	0.087	0.202	0.407	0.011	0.085	0.011	0.086	0.063	0.208
		8	0.028	0.134	0.135	0.325	0.016	0.103	0.037	0.145	0.010	0.085	0.305	0.503	0.011	0.085	0.011	0.087	0.100	0.267
		10	0.029	0.133	0.225	0.421	0.015	0.099	0.030	0.132	0.010	0.084	0.347	0.558	0.010	0.084	0.010	0.085	0.164	0.358
		12	0.022	0.119	0.261	0.470	0.015	0.099	0.039	0.150	0.010	0.083	0.387	0.586	0.010	0.084	0.010	0.084	0.203	0.412
		Avg	0.027	0.129	0.178	0.369	0.016	0.102	0.037	0.145	0.010	0.085	0.310	0.514	0.011	0.085	0.011	0.086	0.133	0.311
Health	MM-TSFLib+Clean	12	1.574	0.938	1.077	0.681	1.405	0.804	1.129	0.777	1.185	0.729	1.123	0.718	0.999	0.624	0.904	0.612	1.175	0.765
		24	1.683	0.936	1.353	0.786	1.534	0.824	1.455	0.920	1.452	0.813	1.410	0.774	1.618	0.765	1.354	0.722	1.265	0.705
		36	1.769	0.953	1.337	0.755	1.579	0.852	1.480	0.912	1.563	0.846	1.493	0.795	1.897	0.848	1.680	0.816	1.306	0.772
		48	1.814	0.960	1.448	0.789	1.631	0.879	1.520	0.916	1.653	0.884	1.560	0.826	1.946	0.889	1.852	0.871	1.434	0.789
		Avg	1.710	0.947	1.304	0.753	1.537	0.840	1.396	0.881	1.463	0.818	1.397	0.778	1.615	0.782	1.448	0.755	1.295	0.758
	TaTS+Clean	12	1.296	0.842	0.939	0.650	1.282	0.765	1.081	0.746	1.123	0.711	0.961	0.663	0.933	0.620	0.795	0.594	0.913	0.641
		24	1.475	0.880	1.253	0.746	1.399	0.790	1.371	0.856	1.362	0.786	1.184	0.724	1.312	0.719	1.198	0.707	1.125	0.709
		36	1.569	0.882	1.265	0.737	1.449	0.809	1.424	0.867	1.421	0.801	1.212	0.733	1.583	0.807	1.453	0.777	1.190	0.717
		48	1.577	0.892	1.348	0.762	1.504	0.834	1.476	0.889	1.495	0.837	1.305	0.777	1.716	0.854	1.592	0.822	1.294	0.751
		Avg	1.479	0.874	1.201	0.724	1.409	0.800	1.338	0.839	1.350	0.784	1.166	0.724	1.386	0.750	1.260	0.725	1.131	0.705
Social Good	MM-TSFLib+Clean	6	0.977	0.552	0.754	0.428	0.946	0.537	0.924	0.476	0.956	0.569	0.742	0.376	1.025	0.516	1.011	0.564	0.773	0.402
		8	1.059	0.584	0.838	0.478	0.986	0.559	1.113	0.517	1.008	0.578	0.781	0.421	1.033	0.532	1.037	0.558	0.835	0.426
		10	1.109	0.609	0.873	0.488	1.046	0.591	1.202	0.567	1.078	0.602	0.829	0.443	1.083	0.544	1.036	0.512	0.854	0.446
		12	1.195	0.656	0.910	0.510	1.112	0.626	1.290	0.603	1.130	0.627	0.847	0.479	1.121	0.582	1.095	0.547	0.873	0.468
		Avg	1.085	0.600	0.844	0.476	1.023	0.578	1.132	0.541	1.043	0.594	0.800	0.430	1.066	0.544	1.045	0.545	0.834	0.436
	TaTS+Clean	6	0.984	0.563	0.770	0.456	0.926	0.528	0.938	0.506	0.854	0.437	0.761	0.382	1.040	0.633	0.969	0.532	0.777	0.399
		8	1.069	0.601	0.820	0.463	1.030	0.575	1.056	0.557	1.013	0.509	0.813	0.410	1.119	0.668	0.929	0.468	0.841	0.423
		10	1.120	0.631	0.884	0.496	1.044	0.585	1.131	0.603	1.108	0.556	0.884	0.445	1.142	0.679	1.057	0.531	0.857	0.429
		12	1.162	0.643	0.923	0.469	1.135	0.626	1.197	0.634	1.171	0.577	0.864	0.442	1.167	0.683	1.221	0.546	0.855	0.456
		Avg	1.084	0.609	0.849	0.471	1.034	0.579	1.081	0.575	1.037	0.520	0.830	0.420	1.117	0.666	1.044	0.519	0.832	0.427
Traffic	MM-TSFLib+Clean	6	0.164	0.259	0.177	0.303	0.251	0.381	0.167	0.248	0.237	0.336	0.163	0.305	0.158	0.226	0.160	0.230	0.148	0.260
		8	0.170	0.260	0.189	0.317	0.243	0.368	0.171	0.248	0.222	0.306	0.156	0.291	0.173	0.232	0.169	0.235	0.157	0.275
		10	0.175	0.271	0.190	0.310	0.225	0.352	0.175	0.249	0.223	0.304	0.159	0.291	0.179	0.238	0.181	0.241	0.157	0.274
		12	0.238	0.300	0.218	0.312	0.259	0.365	0.241	0.294	0.275	0.340	0.201	0.319	0.235	0.267	0.239	0.274	0.194	0.281
		Avg	0.187	0.273	0.194	0.311	0.245	0.367	0.189	0.260	0.239	0.322	0.170	0.302	0.186	0.241	0.187	0.245	0.164	0.273
	TaTS+Clean	6	0.144	0.210	0.158	0.286	0.194	0.314	0.155	0.217	0.171	0.273	0.141	0.259	0.159	0.211	0.149	0.206	0.138	0.244
		8	0.145	0.212	0.162	0.281	0.187	0.307	0.156	0.218	0.173	0.249	0.143	0.268	0.169	0.217	0.161	0.211	0.142	0.254
		10	0.156	0.226	0.165	0.283	0.189	0.309	0.159	0.222	0.173	0.247	0.146	0.271	0.172	0.218	0.169	0.217	0.144	0.255
		12	0.213	0.256	0.194	0.290	0.218	0.313	0.215	0.255	0.217	0.261	0.182	0.296	0.229	0.245	0.226	0.242	0.180	0.270
		Avg	0.164	0.226	0.170	0.285	0.197	0.311	0.171	0.228	0.183	0.258	0.153	0.274	0.182	0.223	0.176	0.219	0.151	0.256

I RESULTS UNDER VARYING MASKING RATIOS

To further examine the behaviour of the proposed module under highly sparse conditions, we conduct a text masking experiment, in which the original text is randomly masked to empty at ratios of 0.3, 0.5, 0.7, and 0.9. The results are reported in Table 28.

Table 28: Performance Stability of PA-RNet under Varying Sparse Input Conditions (Masking Ratios from 0.3 to 0.9).

Dataset	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	Original	0.102	0.231	0.172	0.276	0.150	0.276	0.100	0.228	0.099	0.196	0.207	0.313	0.094	0.207	0.091	0.195	0.153	0.279
	m=0.3	0.101	0.233	0.172	0.276	0.150	0.276	0.100	0.229	0.099	0.196	0.218	0.324	0.094	0.206	0.091	0.195	0.156	0.281
	m=0.5	0.103	0.236	0.172	0.276	0.150	0.276	0.099	0.230	0.099	0.196	0.218	0.323	0.094	0.206	0.091	0.195	0.158	0.281
	m=0.7	0.101	0.232	0.172	0.276	0.150	0.276	0.100	0.231	0.099	0.196	0.216	0.320	0.094	0.206	0.091	0.195	0.159	0.282
	m=0.9	0.105	0.233	0.172	0.276	0.150	0.276	0.100	0.232	0.099	0.196	0.214	0.319	0.095	0.208	0.091	0.195	0.156	0.283
	m Avg	0.105	0.237	0.172	0.276	0.150	0.276	0.101	0.236	0.099	0.196	0.217	0.322	0.094	0.206	0.091	0.195	0.160	0.282
	Promotion	-2.94%	-2.60%	0.00%	0.00%	0.00%	0.00%	-1.00%	-3.51%	0.00%	0.00%	-4.83%	-2.88%	0.00%	0.48%	0.00%	0.00%	-4.58%	-1.08%
Climate	Original	0.972	0.797	1.015	0.782	0.948	0.777	0.957	0.786	0.983	0.795	0.965	0.770	1.016	0.807	0.992	0.796	0.970	0.766
	m=0.3	0.977	0.801	1.015	0.782	0.948	0.777	0.958	0.785	0.983	0.795	0.978	0.776	1.012	0.804	0.992	0.796	0.973	0.768
	m=0.5	0.976	0.799	1.015	0.782	0.948	0.777	0.966	0.789	0.983	0.795	1.003	0.787	1.007	0.802	0.992	0.796	0.977	0.770
	m=0.7	0.973	0.796	1.015	0.782	0.948	0.777	0.958	0.785	0.983	0.795	0.976	0.775	1.004	0.801	0.992	0.796	0.975	0.770
	m=0.9	0.978	0.801	1.015	0.782	0.948	0.777	0.970	0.790	0.983	0.795	0.967	0.771	1.006	0.802	0.992	0.796	0.977	0.770
	m Avg	0.976	0.799	1.015	0.782	0.948	0.777	0.963	0.787	0.983	0.795	0.981	0.777	1.007	0.802	0.992	0.796	0.976	0.770
	Promotion	-0.41%	-0.28%	0.00%	0.00%	0.00%	0.00%	-0.63%	-0.16%	0.00%	0.00%	-1.66%	-0.94%	0.86%	0.59%	0.00%	0.00%	-0.57%	-0.46%
Economy	Original	0.024	0.124	0.157	0.342	0.016	0.102	0.035	0.142	0.010	0.085	0.298	0.493	0.010	0.084	0.011	0.086	0.113	0.280
	m=0.3	0.025	0.126	0.167	0.351	0.016	0.102	0.035	0.142	0.010	0.085	0.306	0.504	0.010	0.084	0.011	0.086	0.159	0.337
	m=0.5	0.024	0.124	0.164	0.350	0.016	0.102	0.035	0.142	0.010	0.085	0.306	0.501	0.010	0.084	0.011	0.086	0.164	0.344
	m=0.7	0.024	0.124	0.161	0.351	0.016	0.102	0.035	0.142	0.010	0.085	0.305	0.500	0.010	0.084	0.011	0.086	0.204	0.400
	m=0.9	0.023	0.122	0.154	0.337	0.016	0.102	0.035	0.142	0.010	0.085	0.309	0.503	0.010	0.084	0.011	0.086	0.115	0.282
	m Avg	0.024	0.124	0.162	0.347	0.016	0.102	0.035	0.142	0.010	0.085	0.307	0.502	0.010	0.084	0.011	0.086	0.161	0.341
	Promotion	0.00%	0.00%	-2.87%	-1.54%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-2.85%	-1.83%	0.00%	0.00%	0.00%	0.00%	-42.04%	-21.70%
Health	Original	1.478	0.875	1.223	0.725	1.409	0.799	1.333	0.838	1.347	0.782	1.158	0.721	1.348	0.747	1.249	0.722	1.126	0.700
	m=0.3	1.488	0.876	1.219	0.729	1.409	0.799	1.327	0.835	1.347	0.782	1.175	0.727	1.354	0.760	1.249	0.722	1.114	0.695
	m=0.5	1.517	0.889	1.213	0.724	1.409	0.799	1.326	0.835	1.347	0.782	1.166	0.722	1.361	0.765	1.249	0.722	1.109	0.694
	m=0.7	1.480	0.883	1.250	0.740	1.409	0.799	1.327	0.837	1.347	0.782	1.154	0.722	1.400	0.770	1.249	0.722	1.114	0.696
	m=0.9	1.489	0.879	1.246	0.738	1.409	0.799	1.321	0.832	1.347	0.782	1.156	0.721	1.403	0.770	1.249	0.722	1.111	0.694
	m Avg	1.494	0.882	1.232	0.733	1.409	0.799	1.325	0.835	1.347	0.782	1.163	0.723	1.380	0.766	1.249	0.722	1.112	0.695
	Promotion	-1.05%	-0.77%	-0.74%	-1.07%	0.00%	0.00%	0.58%	0.39%	0.00%	0.00%	-0.41%	-0.28%	-2.34%	-2.58%	0.00%	0.00%	1.24%	0.75%
Social Good	Original	1.073	0.596	0.844	0.461	1.016	0.569	1.080	0.569	1.033	0.515	0.810	0.417	1.161	0.593	1.041	0.507	0.810	0.426
	m=0.3	1.085	0.607	0.836	0.459	1.016	0.569	1.062	0.557	1.033	0.515	0.809	0.413	1.247	0.654	1.041	0.507	0.824	0.430
	m=0.5	1.091	0.609	0.835	0.458	1.016	0.569	1.071	0.550	1.033	0.515	0.801	0.413	1.214	0.639	1.041	0.507	0.817	0.426
	m=0.7	1.090	0.614	0.833	0.455	1.016	0.569	1.108	0.563	1.033	0.515	0.800	0.417	1.144	0.639	1.041	0.507	0.819	0.429
	m=0.9	1.091	0.612	0.833	0.455	1.016	0.569	1.094	0.570	1.033	0.515	0.817	0.427	1.195	0.625	1.041	0.507	0.833	0.425
	m Avg	1.089	0.611	0.834	0.457	1.016	0.569	1.084	0.560	1.033	0.515	0.807	0.418	1.200	0.639	1.041	0.507	0.823	0.428
	Promotion	-1.51%	-2.43%	1.16%	0.92%	0.00%	0.00%	-0.35%	1.58%	0.00%	0.00%	0.40%	-0.12%	-3.36%	-7.80%	0.00%	0.00%	-1.64%	-0.35%
Traffic	Original	0.162	0.222	0.169	0.283	0.196	0.310	0.170	0.227	0.183	0.257	0.156	0.268	0.178	0.221	0.175	0.219	0.155	0.244
	m=0.3	0.163	0.225	0.169	0.283	0.196	0.310	0.172	0.229	0.183	0.257	0.157	0.276	0.178	0.222	0.175	0.219	0.156	0.250
	m=0.5	0.163	0.224	0.169	0.283	0.196	0.310	0.170	0.229	0.183	0.257	0.153	0.265	0.177	0.221	0.175	0.219	0.154	0.252
	m=0.7	0.162	0.224	0.169	0.283	0.196	0.310	0.171	0.231	0.183	0.257	0.153	0.266	0.177	0.221	0.175	0.219	0.153	0.254
	m=0.9	0.161	0.225	0.169	0.283	0.196	0.310	0.171	0.229	0.183	0.257	0.151	0.265	0.178	0.221	0.175	0.219	0.153	0.253
	m Avg	0.162	0.225	0.169	0.283	0.196	0.310	0.171	0.230	0.183	0.257	0.154	0.268	0.178	0.221	0.175	0.219	0.154	0.252
	Promotion	-0.15%	-1.13%	0.00%	0.00%	0.00%	0.00%	-0.59%	-1.10%	0.00%	0.00%	1.60%	0.00%	0.28%	-0.11%	0.00%	0.00%	0.65%	-3.38%

Table 29: Complete forecasting results under sparse input conditions at masking ratio $m = 0.3$. Lower MSE/MAE indicates better performance.

Dataset	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	6	0.074	0.195	0.093	0.220	0.118	0.249	0.074	0.191	0.065	0.159	0.125	0.260	0.064	0.177	0.060	0.161	0.099	0.246
	8	0.091	0.221	0.146	0.261	0.135	0.264	0.087	0.213	0.084	0.182	0.172	0.297	0.080	0.192	0.077	0.181	0.125	0.267
	10	0.107	0.243	0.197	0.293	0.158	0.283	0.108	0.244	0.108	0.208	0.241	0.337	0.101	0.212	0.099	0.203	0.167	0.292
	12	0.134	0.271	0.252	0.330	0.190	0.307	0.131	0.267	0.139	0.235	0.332	0.401	0.131	0.244	0.129	0.236	0.232	0.318
	Avg	0.101	0.233	0.172	0.276	0.150	0.276	0.100	0.229	0.099	0.196	0.218	0.324	0.094	0.206	0.091	0.195	0.156	0.281
Climate	6	1.021	0.824	0.994	0.772	0.924	0.768	0.920	0.765	0.971	0.784	0.977	0.780	0.985	0.793	0.950	0.780	0.925	0.741
	8	0.978	0.806	1.031	0.785	0.940	0.774	0.939	0.776	0.970	0.791	0.999	0.782	0.993	0.793	0.973	0.785	0.954	0.757
	10	0.950	0.789	1.016	0.785	0.960	0.782	0.987	0.803	0.992	0.801	0.963	0.768	1.040	0.816	1.015	0.806	0.999	0.780
	12	0.960	0.785	1.017	0.787	0.968	0.782	0.985	0.797	1.001	0.805	0.973	0.775	1.031	0.815	1.029	0.812	1.013	0.792
	Avg	0.977	0.801	1.015	0.782	0.948	0.777	0.958	0.785	0.983	0.795	0.978	0.776	1.012	0.804	0.992	0.796	0.973	0.768
Economy	6	0.024	0.124	0.072	0.227	0.018	0.108	0.036	0.144	0.011	0.086	0.162	0.355	0.011	0.085	0.011	0.087	0.076	0.228
	8	0.030	0.138	0.159	0.357	0.016	0.103	0.035	0.142	0.010	0.085	0.257	0.467	0.010	0.084	0.011	0.087	0.155	0.336
	10	0.025	0.126	0.185	0.369	0.015	0.099	0.032	0.134	0.010	0.084	0.350	0.556	0.010	0.083	0.010	0.085	0.179	0.380
	12	0.022	0.116	0.252	0.450	0.015	0.099	0.038	0.146	0.010	0.083	0.454	0.637	0.010	0.082	0.010	0.084	0.224	0.404
	Avg	0.025	0.126	0.167	0.351	0.016	0.102	0.035	0.142	0.010	0.085	0.306	0.504	0.010	0.084	0.011	0.086	0.159	0.337
Health	12	1.352	0.850	1.000	0.674	1.287	0.766	1.059	0.736	1.125	0.712	0.969	0.677	0.935	0.638	0.783	0.592	0.872	0.631
	24	1.450	0.867	1.265	0.752	1.398	0.789	1.372	0.862	1.344	0.775	1.146	0.705	1.314	0.739	1.149	0.693	1.150	0.705
	36	1.600	0.914	1.263	0.724	1.442	0.810	1.414	0.863	1.420	0.801	1.219	0.736	1.576	0.825	1.446	0.777	1.140	0.695
	48	1.549	0.874	1.349	0.765	1.509	0.830	1.461	0.880	1.499	0.838	1.365	0.790	1.589	0.836	1.619	0.827	1.292	0.749
	Avg	1.488	0.876	1.219	0.729	1.409	0.799	1.327	0.835	1.347	0.782	1.175	0.727	1.354	0.760	1.249	0.722	1.114	0.695
Social Good	6	0.990	0.550	0.756	0.419	0.917	0.522	0.890	0.486	0.854	0.429	0.745	0.384	1.212	0.659	0.970	0.523	0.770	0.393
	8	1.070	0.615	0.819	0.444	1.004	0.563	1.057	0.558	0.998	0.497	0.815	0.406	1.191	0.637	0.995	0.473	0.788	0.406
	10	1.107	0.609	0.882	0.497	1.034	0.578	1.120	0.576	1.104	0.551	0.808	0.407	1.300	0.666	1.072	0.496	0.845	0.447
	12	1.174	0.653	0.887	0.477	1.109	0.612	1.180	0.607	1.176	0.581	0.868	0.453	1.283	0.654	1.128	0.536	0.893	0.473
	Avg	1.085	0.607	0.836	0.459	1.016	0.569	1.062	0.557	1.033	0.515	0.809	0.413	1.247	0.654	1.041	0.507	0.824	0.430
Traffic	6	0.146	0.218	0.156	0.276	0.190	0.311	0.147	0.205	0.171	0.272	0.145	0.265	0.153	0.209	0.148	0.205	0.145	0.250
	8	0.147	0.213	0.161	0.280	0.187	0.306	0.153	0.211	0.172	0.248	0.147	0.271	0.166	0.216	0.160	0.213	0.146	0.245
	10	0.151	0.218	0.164	0.284	0.189	0.310	0.170	0.241	0.173	0.246	0.156	0.289	0.167	0.217	0.168	0.215	0.149	0.252
	12	0.208	0.251	0.194	0.290	0.217	0.313	0.218	0.259	0.217	0.261	0.181	0.278	0.224	0.245	0.225	0.242	0.183	0.254
	Avg	0.163	0.225	0.169	0.283	0.196	0.310	0.172	0.229	0.183	0.257	0.157	0.276	0.178	0.222	0.175	0.219	0.156	0.250

Table 30: Complete forecasting results under sparse input conditions at masking ratio $m = 0.5$. Lower MSE/MAE indicates better performance.

Dataset	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	6	0.076	0.203	0.093	0.220	0.118	0.249	0.074	0.192	0.065	0.159	0.124	0.252	0.064	0.176	0.060	0.161	0.098	0.243
	8	0.095	0.228	0.146	0.261	0.135	0.264	0.086	0.213	0.084	0.182	0.170	0.296	0.080	0.192	0.077	0.181	0.125	0.264
	10	0.106	0.241	0.197	0.293	0.158	0.283	0.107	0.246	0.108	0.208	0.244	0.340	0.101	0.212	0.099	0.203	0.173	0.295
	12	0.136	0.270	0.252	0.330	0.190	0.307	0.131	0.268	0.139	0.235	0.335	0.402	0.131	0.244	0.129	0.236	0.235	0.322
	Avg	0.103	0.236	0.172	0.276	0.150	0.276	0.099	0.230	0.099	0.196	0.218	0.323	0.094	0.206	0.091	0.195	0.158	0.281
Climate	6	1.012	0.816	0.994	0.772	0.924	0.768	0.918	0.765	0.971	0.784	1.018	0.794	0.985	0.792	0.950	0.780	0.920	0.739
	8	0.971	0.802	1.031	0.785	0.940	0.774	0.938	0.776	0.970	0.791	1.006	0.788	0.992	0.793	0.973	0.785	0.957	0.760
	10	0.961	0.792	1.016	0.785	0.960	0.782	0.989	0.802	0.992	0.801	0.971	0.771	1.024	0.810	1.015	0.806	1.010	0.786
	12	0.960	0.785	1.017	0.787	0.968	0.782	1.021	0.812	1.001	0.805	1.017	0.793	1.029	0.814	1.029	0.812	1.022	0.794
	Avg	0.976	0.799	1.015	0.782	0.948	0.777	0.966	0.789	0.983	0.795	1.003	0.787	1.007	0.802	0.992	0.796	0.977	0.770
Economy	6	0.026	0.130	0.068	0.219	0.018	0.108	0.036	0.144	0.011	0.086	0.163	0.355	0.011	0.085	0.011	0.087	0.102	0.280
	8	0.027	0.129	0.155	0.351	0.016	0.103	0.035	0.142	0.010	0.085	0.251	0.462	0.010	0.085	0.011	0.087	0.116	0.289
	10	0.023	0.122	0.186	0.382	0.015	0.099	0.032	0.134	0.010	0.084	0.348	0.548	0.010	0.084	0.010	0.085	0.159	0.350
	12	0.021	0.114	0.248	0.447	0.015	0.099	0.038	0.146	0.010	0.083	0.462	0.640	0.010	0.082	0.010	0.084	0.277	0.456
	Avg	0.024	0.124	0.164	0.350	0.016	0.102	0.035	0.142	0.010	0.085	0.306	0.501	0.010	0.084	0.011	0.086	0.164	0.344
Health	12	1.369	0.857	0.981	0.662	1.287	0.766	1.073	0.739	1.125	0.712	0.954	0.666	1.023	0.663	0.783	0.592	0.873	0.635
	24	1.533	0.896	1.216	0.730	1.398	0.789	1.356	0.856	1.344	0.775	1.115	0.694	1.323	0.747	1.149	0.693	1.147	0.703
	36	1.577	0.914	1.281	0.738	1.442	0.810	1.414	0.863	1.420	0.801	1.213	0.732	1.510	0.810	1.446	0.777	1.140	0.695
	48	1.589	0.887	1.372	0.765	1.509	0.830	1.461	0.880	1.499	0.838	1.381	0.797	1.589	0.838	1.619	0.827	1.276	0.742
	Avg	1.517	0.889	1.213	0.724	1.409	0.799	1.326	0.835	1.347	0.782	1.166	0.722	1.361	0.765	1.249	0.722	1.109	0.694
Social Good	6	1.001	0.552	0.756	0.419	0.917	0.522	0.899	0.476	0.854	0.429	0.738	0.388	1.096	0.624	0.970	0.523	0.776	0.387
	8	1.063	0.611	0.818	0.445	1.004	0.563	1.114	0.545	0.998	0.497	0.790	0.400	1.251	0.617	0.995	0.473	0.796	0.411
	10	1.110	0.610	0.882	0.496	1.034	0.578	1.083	0.568	1.104	0.551	0.834	0.416	1.255	0.655	1.072	0.496	0.814	0.439
	12	1.190	0.662	0.882	0.474	1.109	0.612	1.187	0.612	1.176	0.581	0.842	0.448	1.253	0.658	1.128	0.536	0.881	0.466
	Avg	1.091	0.609	0.835	0.458	1.016	0.569	1.071	0.550	1.033	0.515	0.801	0.413	1.214	0.639	1.041	0.507	0.817	0.426
Traffic	6	0.145	0.210	0.156	0.276	0.190	0.311	0.147	0.208	0.171	0.272	0.139	0.249	0.150	0.207	0.148	0.205	0.142	0.243
	8	0.146	0.211	0.161	0.280	0.187	0.306	0.154	0.214	0.172	0.248	0.145	0.266	0.163	0.214	0.160	0.213	0.145	0.249
	10	0.152	0.223	0.164	0.284	0.189	0.310	0.161	0.233	0.173	0.246	0.150	0.277	0.169	0.217	0.168	0.215	0.148	0.254
	12	0.208	0.253	0.194	0.290	0.217	0.313	0.217	0.262	0.217	0.261	0.178	0.268	0.224	0.246	0.225	0.242	0.183	0.260
	Avg	0.163	0.224	0.169	0.283	0.196	0.310	0.170	0.229	0.183	0.257	0.153	0.265	0.177	0.221	0.175	0.219	0.154	0.252

Table 31: Complete forecasting results under sparse input conditions at masking ratio $m = 0.7$. Lower MSE/MAE indicates better performance.

Dataset	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	6	0.073	0.191	0.093	0.220	0.118	0.249	0.074	0.190	0.065	0.159	0.118	0.252	0.064	0.177	0.060	0.161	0.101	0.247
	8	0.092	0.224	0.146	0.261	0.135	0.264	0.087	0.214	0.084	0.182	0.173	0.295	0.080	0.190	0.077	0.181	0.126	0.266
	10	0.105	0.241	0.197	0.293	0.158	0.283	0.108	0.250	0.108	0.208	0.243	0.339	0.101	0.212	0.099	0.203	0.172	0.293
	12	0.136	0.271	0.252	0.330	0.190	0.307	0.131	0.268	0.139	0.235	0.328	0.395	0.131	0.244	0.129	0.236	0.235	0.322
	Avg	0.101	0.232	0.172	0.276	0.150	0.276	0.100	0.231	0.099	0.196	0.216	0.320	0.094	0.206	0.091	0.195	0.159	0.282
Climate	6	1.015	0.819	0.994	0.772	0.924	0.768	0.919	0.766	0.971	0.784	0.977	0.775	0.975	0.788	0.950	0.780	0.920	0.740
	8	0.948	0.789	1.031	0.785	0.940	0.774	0.939	0.776	0.970	0.791	0.980	0.777	0.994	0.794	0.973	0.785	0.954	0.759
	10	0.958	0.788	1.016	0.785	0.960	0.782	0.989	0.802	0.992	0.801	0.963	0.766	1.021	0.809	1.015	0.806	1.016	0.788
	12	0.970	0.788	1.017	0.787	0.968	0.782	0.985	0.797	1.001	0.805	0.986	0.780	1.026	0.814	1.029	0.812	1.010	0.791
	Avg	0.973	0.796	1.015	0.782	0.948	0.777	0.958	0.785	0.983	0.795	0.976	0.775	1.004	0.801	0.992	0.796	0.975	0.770
Economy	6	0.023	0.123	0.081	0.241	0.018	0.108	0.036	0.144	0.011	0.086	0.158	0.352	0.011	0.086	0.011	0.087	0.133	0.328
	8	0.029	0.136	0.130	0.320	0.016	0.103	0.035	0.142	0.010	0.085	0.263	0.469	0.010	0.085	0.011	0.087	0.159	0.354
	10	0.024	0.126	0.208	0.408	0.015	0.099	0.032	0.134	0.010	0.084	0.352	0.550	0.010	0.084	0.010	0.085	0.196	0.404
	12	0.019	0.110	0.226	0.434	0.015	0.099	0.038	0.146	0.010	0.083	0.445	0.628	0.010	0.082	0.010	0.084	0.329	0.516
	Avg	0.024	0.124	0.161	0.351	0.016	0.102	0.035	0.142	0.010	0.085	0.305	0.500	0.010	0.084	0.011	0.086	0.204	0.400
Health	12	1.289	0.840	1.071	0.717	1.287	0.766	1.088	0.756	1.125	0.712	0.986	0.682	0.998	0.648	0.783	0.592	0.905	0.642
	24	1.515	0.897	1.272	0.733	1.398	0.789	1.346	0.850	1.344	0.775	1.109	0.692	1.349	0.745	1.149	0.693	1.149	0.705
	36	1.549	0.901	1.312	0.750	1.442	0.810	1.414	0.863	1.420	0.801	1.214	0.736	1.551	0.824	1.446	0.777	1.138	0.695
	48	1.567	0.892	1.346	0.759	1.509	0.830	1.461	0.880	1.499	0.838	1.305	0.776	1.702	0.863	1.619	0.827	1.265	0.740
	Avg	1.480	0.883	1.250	0.740	1.409	0.799	1.327	0.837	1.347	0.782	1.154	0.722	1.400	0.770	1.249	0.722	1.114	0.696
Social Good	6	0.997	0.556	0.756	0.419	0.917	0.522	0.960	0.507	0.854	0.429	0.738	0.385	1.065	0.624	0.970	0.523	0.751	0.395
	8	1.093	0.634	0.814	0.439	1.004	0.563	1.166	0.569	0.998	0.497	0.800	0.412	1.147	0.648	0.995	0.473	0.787	0.402
	10	1.105	0.612	0.881	0.496	1.034	0.578	1.073	0.548	1.104	0.551	0.819	0.426	1.182	0.626	1.072	0.496	0.861	0.443
	12	1.166	0.654	0.882	0.466	1.109	0.612	1.231	0.628	1.176	0.581	0.842	0.443	1.181	0.657	1.128	0.536	0.877	0.476
	Avg	1.090	0.614	0.833	0.455	1.016	0.569	1.108	0.563	1.033	0.515	0.800	0.417	1.144	0.639	1.041	0.507	0.819	0.429
Traffic	6	0.143	0.213	0.156	0.276	0.190	0.311	0.148	0.209	0.171	0.272	0.140	0.252	0.150	0.207	0.148	0.205	0.142	0.242
	8	0.144	0.210	0.161	0.280	0.187	0.306	0.157	0.221	0.172	0.248	0.142	0.263	0.164	0.214	0.160	0.213	0.142	0.247
	10	0.150	0.219	0.164	0.284	0.189	0.310	0.164	0.233	0.173	0.246	0.149	0.277	0.167	0.217	0.168	0.215	0.146	0.254
	12	0.211	0.254	0.194	0.290	0.217	0.313	0.216	0.261	0.217	0.261	0.179	0.273	0.226	0.246	0.225	0.242	0.184	0.272
	Avg	0.162	0.224	0.169	0.283	0.196	0.310	0.171	0.231	0.183	0.257	0.153	0.266	0.177	0.221	0.175	0.219	0.153	0.254

Table 32: Complete forecasting results under sparse input conditions at masking ratio $m = 0.9$. Lower MSE/MAE indicates better performance.

Dataset	T	Autoformer		Crossformer		DLinear		FEDformer		FiLM		Informer		iTransformer		PatchTST		Transformer	
		MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE
Agriculture	6	0.078	0.203	0.093	0.220	0.118	0.249	0.075	0.194	0.065	0.159	0.124	0.261	0.065	0.178	0.060	0.161	0.100	0.245
	8	0.096	0.227	0.146	0.261	0.135	0.264	0.088	0.220	0.084	0.182	0.168	0.289	0.081	0.192	0.077	0.181	0.124	0.262
	10	0.109	0.245	0.197	0.293	0.158	0.283	0.111	0.260	0.108	0.208	0.247	0.344	0.101	0.212	0.099	0.203	0.177	0.296
	12	0.136	0.273	0.252	0.330	0.190	0.307	0.131	0.271	0.139	0.235	0.327	0.393	0.130	0.242	0.129	0.236	0.237	0.323
	Avg	0.105	0.237	0.172	0.276	0.150	0.276	0.101	0.236	0.099	0.196	0.217	0.322	0.094	0.206	0.091	0.195	0.160	0.282
Climate	6	1.015	0.823	0.994	0.772	0.924	0.768	0.923	0.765	0.971	0.784	0.977	0.776	0.974	0.789	0.950	0.780	0.922	0.742
	8	0.963	0.801	1.031	0.785	0.940	0.774	0.938	0.776	0.970	0.791	0.961	0.768	0.989	0.792	0.973	0.785	0.961	0.760
	10	0.964	0.789	1.016	0.785	0.960	0.782	0.991	0.802	0.992	0.801	0.954	0.762	1.032	0.813	1.015	0.806	1.014	0.785
	12	0.972	0.792	1.017	0.787	0.968	0.782	1.028	0.815	1.001	0.805	0.977	0.777	1.029	0.815	1.029	0.812	1.009	0.791
	Avg	0.978	0.801	1.015	0.782	0.948	0.777	0.970	0.790	0.983	0.795	0.967	0.771	1.006	0.802	0.992	0.796	0.977	0.770
Economy	6	0.023	0.120	0.068	0.218	0.018	0.108	0.036	0.144	0.011	0.086	0.166	0.358	0.011	0.085	0.011	0.087	0.066	0.206
	8	0.027	0.130	0.127	0.313	0.016	0.103	0.035	0.142	0.010	0.085	0.264	0.468	0.010	0.085	0.011	0.087	0.112	0.272
	10	0.023	0.122	0.173	0.358	0.015	0.099	0.032	0.134	0.010	0.084	0.351	0.552	0.010	0.084	0.010	0.085	0.148	0.336
	12	0.020	0.114	0.246	0.459	0.015	0.099	0.038	0.146	0.010	0.083	0.455	0.634	0.010	0.082	0.010	0.084	0.136	0.312
	Avg	0.023	0.122	0.154	0.337	0.016	0.102	0.035	0.142	0.010	0.085	0.309	0.503	0.010	0.084	0.011	0.086	0.115	0.282
Health	12	1.350	0.856	1.060	0.704	1.287	0.766	1.054	0.732	1.125	0.712	0.965	0.673	0.994	0.640	0.783	0.592	0.884	0.635
	24	1.517	0.890	1.282	0.757	1.398	0.789	1.354	0.853	1.344	0.775	1.115	0.695	1.356	0.751	1.149	0.693	1.145	0.705
	36	1.541	0.894	1.268	0.732	1.442	0.810	1.414	0.863	1.420	0.801	1.240	0.742	1.556	0.822	1.446	0.777	1.140	0.694
	48	1.549	0.877	1.372	0.761	1.509	0.830	1.461	0.880	1.499	0.838	1.302	0.773	1.704	0.866	1.619	0.827	1.276	0.744
	Avg	1.489	0.879	1.246	0.738	1.409	0.799	1.321	0.832	1.347	0.782	1.156	0.721	1.403	0.770	1.249	0.722	1.111	0.694
Social Good	6	0.991	0.545	0.756	0.419	0.917	0.522	0.915	0.491	0.854	0.429	0.777	0.402	1.091	0.588	0.970	0.523	0.755	0.372
	8	1.091	0.637	0.814	0.439	1.004	0.563	1.065	0.566	0.998	0.497	0.821	0.420	1.152	0.611	0.995	0.473	0.819	0.406
	10	1.105	0.611	0.880	0.496	1.034	0.578	1.116	0.590	1.104	0.551	0.817	0.431	1.283	0.644	1.072	0.496	0.868	0.442
	12	1.175	0.654	0.882	0.466	1.109	0.612	1.279	0.633	1.176	0.581	0.851	0.455	1.252	0.656	1.128	0.536	0.891	0.481
	Avg	1.091	0.612	0.833	0.455	1.016	0.569	1.094	0.570	1.033	0.515	0.817	0.427	1.195	0.625	1.041	0.507	0.833	0.425
Traffic	6	0.140	0.208	0.156	0.276	0.190	0.311	0.151	0.211	0.171	0.272	0.140	0.257	0.151	0.208	0.148	0.205	0.140	0.247
	8	0.144	0.213	0.161	0.280	0.187	0.306	0.153	0.216	0.172	0.248	0.142	0.264	0.165	0.214	0.160	0.213	0.143	0.249
	10	0.151	0.226	0.164	0.284	0.189	0.310	0.164	0.227	0.173	0.246	0.145	0.268	0.168	0.217	0.168	0.215	0.145	0.253
	12	0.209	0.251	0.194	0.290	0.217	0.313	0.216	0.260	0.217	0.261	0.177	0.272	0.226	0.245	0.225	0.242	0.183	0.264
	Avg	0.161	0.225	0.169	0.283	0.196	0.310	0.171	0.229	0.183	0.257	0.151	0.265	0.178	0.221	0.175	0.219	0.153	0.253

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This work studies robust multimodal time-series forecasting under noisy textual conditions. The proposed method may be useful for applications where numerical time-series data are accompanied by textual information, such as event descriptions, reports, or news summaries. By improving the model's ability to handle corrupted or incomplete textual inputs, this work may help reduce the sensitivity of forecasting systems to imperfect auxiliary text.

However, the practical impact of the method depends on the application scenario and the quality of the available data. Forecasting errors may still occur, especially when textual information is severely corrupted, biased, or inconsistent with the numerical signals. In high-stakes domains such as healthcare, energy management, public safety, or transportation, inaccurate predictions may lead to inappropriate decisions if they are used without sufficient human verification. Therefore, the proposed method should not be viewed as a standalone decision-making system. Practical deployment should involve careful validation, uncertainty estimation, and supervision from domain experts.