



Department of Sociology and Social Research

Master's Degree in Data Science

A cross-country analysis of artificial intelligence media coverage:
LLM and NLP comparison

Supervisor:
Prof. Ivano Bison

Co-supervisors:
Kaveh Kadkhoda, PhD
Riccardo Gallotti, PhD

Graduating student:
Tommaso Grotto

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Abstract

This study examines how artificial intelligence (AI) is framed and the sentiment associated with it in news media across ten countries, which are Brazil, China, France, Germany, India, Italy, Japan, Russia, United Kingdom, and United States, between June 1st, 2024 and June 1st, 2025. Drawing on a multilingual dataset of 9,909 articles collected via the Media Cloud platform, the analysis integrates large language model (LLM) for frame and sentiment classification, and traditional natural language processing (NLP) methods. Frames and sentiment were extracted using Gemini 2.5 Flash and compared with lexicon-based sentiment analysis (VADER), and topic modeling (BERTopic). Supervised machine learning predictions based on TF-IDF features were also employed to test their reliability.

Results show that “AI impacts on businesses, economy, and jobs” and “AI-based innovative solutions” frames dominate global AI coverage, accounting for nearly half of all articles. Cross-national differences reflect distinct socio-political priorities, for example, Japan, Germany, and the UK emphasize competitiveness and industrial progress, while China focuses on AI’s geopolitical and national security dimensions. Sentiment analysis reveals an overall positive tone, strongest for innovation, healthcare, and business-related frames, and a negative coverage surrounding politics, ethics, and data privacy. Temporal fluctuations in sentiment were linked to country-specific events, though overall optimism persisted.

Methodologically, LLM-based classification produced more nuanced and reliable results than traditional NLP approaches. Machine learning predictions performed moderately for frame detection but poorly for sentiment prediction. The study contributes to global media research by extending comparative, multilingual analyses of AI coverage and by evaluating LLMs as tools for classifying news articles’ frames and sentiment.

1. Introduction

Artificial intelligence (AI) has become a defining technology of the twenty-first century, reshaping economic systems, political debates, and everyday life. Alongside these developments, media coverage plays a central role in shaping public understanding and societal perceptions of AI. Through journalistic framing, news outlets highlight certain aspects of AI, such as innovation or risk, while downplaying others, thereby influencing how citizens and policymakers make sense of technological change. Understanding how AI is framed in the media and the sentiment associated with it is, therefore, crucial for assessing its broader cultural, political, and economic impact.

Research on AI media coverage has expanded rapidly in recent years, demonstrating the diversity of frames through which AI is presented. Prior studies have shown that AI is often discussed in terms of economic growth, innovation, and productivity, but also in relation to risks such as bias, privacy, and ethical dilemmas. Importantly, comparative studies highlight how these frames differ across countries depending on political institutions, economic priorities, and cultural contexts. For instance, while media in some countries emphasize regulation and ethics, others focus more heavily on innovation and national competitiveness. Despite these advances, significant gaps remain, most cross-country analyses still rely primarily on English-language sources, and many employ traditional lexicon-based sentiment analysis tools that may overlook contextual nuances.

At the same time, methodological advances in computational text analysis provide new opportunities to address these challenges. Topic modeling approaches such as Latent Dirichlet Allocation (LDA) or BERTopic have been applied to large corpora of news articles, enabling the discovery of dominant themes. More recently, Large Language Models (LLMs), such as Gemini or GPT-4, offer the possibility of directly annotating frames and sentiment in a way that leverages context-aware reasoning. Yet few studies systematically compare the performance of LLM-based classification with more traditional Natural Language Processing (NLP) results, leaving open questions about their relative strengths, limitations, and complementarity.

This study seeks to fill these gaps by conducting a cross-country analysis of AI media coverage across ten countries, which are Brazil, China, France, Germany, India, Italy, Japan, Russia, United Kingdom, and United States. By focusing not only on English-language material but also on news articles in Portuguese, Chinese, French, German, Italian, Japanese, and Russian, the study expands the scope of comparative research on AI discourse. A large dataset of 9,909 news articles was collected through the Media Cloud platform, spanning the period from June 1st, 2024, to June 1st, 2025.

The analysis addresses six research questions: (1) Which frames of AI are most present in global media over the past year? (2) How do frame frequencies differ across countries? (3) How is sentiment associated with each frame? (4) How does sentiment fluctuate over time? (5) How do sentiment scores differ across countries? (6) What are the differences between results produced using LLM-based classification and traditional NLP approaches?

To answer these questions, this study applies a hybrid methodology. Frames and sentiment are extracted using Gemini 2.5 Flash, an LLM capable of handling multilingual data. These results are compared with lexicon-based sentiment analysis using VADER and topic modeling results using BERTopic. Additionally, predictive NLP approach based on TF-IDF vectorization has been applied with regression and classification machine learning models, to test the feasibility of predicting the frame and sentiment of news articles using supervised machine learning methods.

This study seeks to contribute to the existing literature by, first, extending cross-national research on AI media coverage by systematically including non-English sources; second, it provides one of the first direct comparisons between LLM-based classification and traditional NLP pipelines for frame and sentiment analysis in the media domain; and lastly, it leverages a large, diverse dataset spanning ten countries, allowing for fine-grained comparisons of framing and sentiment dynamics across different socio-political contexts.

2. Literature review

Research on media coverage of artificial intelligence (AI) has expanded rapidly over the past decade, mirroring the growing societal relevance of AI and the media's role in shaping public perceptions of emerging technologies. Journalism functions as a key mediator between scientific innovation and public understanding, influencing how people imagine, trust, and regulate AI (Cave et al., 2019; Jones, 2021). Much of this work has relied on framing theory as an analytical lens to uncover how AI is represented across contexts. Studies consistently find that AI is framed through narratives of technological progress, economic opportunity, ethical concern, and existential risk, although the emphasis and tone vary across countries,

outlets, and periods (Cave et al., 2019; Brennen, Howard, & Nielsen, 2018; Chuan, Tsai, & Cho, 2019).

In the United Kingdom, Brennen, Howard, and Nielsen (2018) found that AI coverage was largely industry-led and oriented around corporate developments rather than public deliberation, with narratives reflecting political and economic interests. Similarly, Chuan, Tsai, and Cho (2019) showed that U.S. newspapers framed AI mainly in business and technology terms, emphasizing benefits like innovation and efficiency while addressing risks such as job loss and bias with greater specificity. Remaining in the Anglo-American contexts, Nguyen and Hekman (2024) demonstrated that The New York Times, The Guardian, Wired, and Gizmodo became more critical over time, particularly around issues of surveillance, discrimination, and information disorder. Other national studies confirm these trends, for instance, Tuasikal and Gunawan (2024) revealed that Indonesian media remain dominated by elite and business perspectives, while Fernandez et al. (2024) found that Brazilian outlets highlighted AI's implications for employment, regulation, and disinformation.

Comparative studies underscore that AI framing reflects national sociopolitical priorities and levels of technological development. Wang, Downey, and Yang (2023) identified both utopian and dystopian imaginaries in British, Chinese, and Indian coverage, showing that cultural and political factors shape how AI's risks and opportunities are communicated. Ittefaq et al. (2025), analyzing nearly 39,000 articles from 12 countries, identified nine dominant frames, spanning business, governance, ethics, jobs, and climate, and documented systematic differences between regions. Global North outlets emphasized regulation, accountability, and ethics, whereas Global South media highlighted innovation, competitiveness, and national progress. Similarly, Ji, Kuai, and Zamith (2024) found that Chinese media balanced a watchdog role with deference to state narratives, framing AI as part of national modernization and global leadership efforts. Other studies, such as Floridi et al. (2018) and Zeng et al. (2021), also show that public discourse around AI is often used to legitimize broader economic and political agendas, including the pursuit of "technological sovereignty" and the digital economy.

A growing body of research focuses on the affective dimension of AI discourse through sentiment analysis. Vergeer (2020) observed that Dutch newspapers maintained a balanced tone over time, alternating between optimism and caution. Garvey and Maskal (2020) challenged the notion that AI is portrayed primarily negatively, finding instead a nuanced spectrum of sentiment depending on topic and outlet. By contrast, studies of recent years highlight an increase in anxiety-driven narratives. Ryazanov, Öhman, and Björklund (2024) documented a surge in critical reporting following the release of ChatGPT, while Sanguinetti and Palomo (2024) found a measurable rise in "AI anxiety" and negative sentiment across European and American media. This shift coincides with a broader trend toward scrutinizing generative AI's social, ethical, and epistemic consequences (Brennen et al., 2023; Jakesch et al., 2024). Other analyses (Zhou & Pan, 2022; West & Allen, 2021) link this negative turn to concerns about misinformation, algorithmic bias, and labor displacement.

Computational methods, particularly topic modeling and natural language processing (NLP), have become central in this research. Ittefaq et al. (2025) used Latent Dirichlet Allocation (LDA) to detect frames across large multilingual corpora, while Xian et al. (2024) employed BERTopic to map global discussions of generative AI, revealing clusters centered on business, regulation, education, and security. Likewise, Jakesch et al. (2022) applied network and co-occurrence analysis to explore AI-related themes in U.S. news, and Searle et al. (2021) compared traditional dictionary-based sentiment analysis with machine learning

techniques. Other works combined computational and qualitative methods, such as Roe and Perkins (2023), who used thematic analysis of UK headlines to interpret how AI metaphors evolve, while Nguyen (2023) applied dictionary-based techniques to map discourses of “data risk” and privacy. Importantly, Allaham, Kieslich, and Diakopoulos (2025) are one of the first to apply the use of LLMs for text analysis. For their study, they utilized OpenAI API for automated annotation of AI’s negative societal impacts.

Scholars have also investigated how audiences interpret AI media coverage. Fast and Horvitz (2017) demonstrated that exposure to AI news influences perceptions of control and safety, while Cave et al. (2019) observed that metaphors like “machine learning revolution” or “superintelligence threat” play a central role in shaping moral judgments about AI. Long and Möller (2022) extended this line of inquiry to social media, showing that Twitter discussions amplify polarizing narratives about AI ethics and job automation. Other studies (van Atteveldt et al., 2021; Klingenberg et al., 2023) have highlighted the potential of cross-platform analyses combining news and social media to trace the evolution of AI frames and their emotional valence.

Despite these methodological innovations, several limitations persist. Most comparative studies (e.g., Ittefaq et al., 2025; Wang et al., 2023) rely primarily on English-language data, underrepresenting media ecosystems in non-English-speaking countries. Even when non-English texts are included, translation pipelines may obscure cultural nuances and linguistic subtleties. Furthermore, sentiment analysis still often depends on lexicon-based tools such as SentiStrength or VADER (Thelwall, 2017), which have limited adaptability to multilingual and context-specific vocabularies. Recent advances in transformer-based models, such as BERT, and LLMs, such as Gemini and GPT, offer new possibilities for context-aware annotation, but these methods have not been systematically compared in their performance. Another key gap concerns scale: while earlier works analyzed a few hundred or thousands of articles, comprehensive multi-country studies integrating both framing and sentiment dimensions remain rare.

This study aims to address these limitations by conducting a cross-country analysis of AI news coverage across multiple languages, including non-English corpora. It compares LLM-based classification with traditional NLP approaches, offering a direct methodological evaluation largely absent in previous research. Furthermore, by leveraging a large, multilingual dataset spanning diverse outlets and national contexts, this project moves beyond the narrow, English-centric samples typical of prior studies. In doing so, it contributes new insights into how AI is framed and emotionally positioned in global media and evaluates the emerging role of LLMs as analytical instruments for computational communication research.

3. Research questions and data description

This study will address six research questions, which are:

Q1: Which frames of artificial intelligence are most present in global media over the past year?

Q2: How do the frame frequencies differ across countries?

Q3: How is the sentiment associated with each frame?

Q4: How does the sentiment fluctuate over time?

Q5: How do sentiment scores differ across countries?

Q6: What are the differences between results produced using LLM-based classification and traditional NLP approaches?

The data used to answer these questions has been collected through the use of Media Cloud, an open-source platform and research tool developed by MIT and Harvard's Berkman Klein Center, that collects large amounts of online news media content from the world (Roberts et al. 2021). Data was collected using Media Cloud API, which allows the users to specify the temporal range, a keyword, and the collection codes, to select the countries and type of news to extract. For this study, the temporal range is from June 1st, 2024, to June 1st, 2025, and the keyword is ‘artificial intelligence’, translated into the national language of the country of interest. The ‘National’ code and the ‘State & Local’ code were used for the ten countries that were selected. The countries are Brazil, China, France, Germany, India, Italy, Japan, Russia, United Kingdom, and United States. These ten countries were selected to represent a diversity of economies, political systems, cultures, and levels of technological advancement, while also each having significant global relevance.

Table 1: Population, GDP, Global AI Engagement Rank, and Press Freedom Rank for each country.

| Country | Population (Millions) | GDP (USD Trillions) | Global AI Engagement Rank | Global AI Vibrancy Rank | Press Freedom Rank |
|----------------|-----------------------|---------------------|---------------------------|-------------------------|--------------------|
| Brazil | 211.998 | 2.179 | 13 | 34 | 63 |
| China | 1,408.975 | 18.744 | 2 | 2 | 178 |
| France | 68.516 | 3.162 | 10 | 6 | 25 |
| Germany | 83.510 | 4.66 | 4 | 8 | 11 |
| India | 1,450.935 | 3.913 | 3 | 4 | 151 |
| Italy | 58.986 | 2.373 | 19 | 22 | 49 |
| Japan | 123.975 | 4.026 | 9 | 9 | 66 |
| Russia | 143.533 | 2.174 | 5 | 29 | 171 |
| United Kingdom | 69.226 | 3.644 | 7 | 3 | 20 |
| United States | 340.110 | 29.185 | 1 | 1 | 57 |

Sources: Population ([World Bank](#)), GDP ([World Bank](#)), Global AI Engagement Rank ([ApX Machine Learning](#)), Global AI Vibrancy Rank ([Stanford HAI](#)), Press Freedom Rank ([Reporters Without Borders](#))

The table provides key country-level indicators that contextualize differences in artificial intelligence (AI) media coverage. Population and Gross Domestic Product are drawn from World Bank statistics and represent the demographic and economic scale of each country. The global AI engagement rank, reported by ApX Machine Learning, measures the extent to which countries are involved in AI-related activities such as research output, policy

initiatives, and industrial adoption, with lower ranks indicating stronger engagement. The global AI vibrancy rank, reported by Stanford HAI, captures a broader measure of AI activity by combining dimensions such as research publications, talent, investment, and policy, again with lower scores reflecting higher vibrancy. Lastly, the press freedom rank, provided by Reporters Without Borders, evaluates the level of freedom available to journalists, with lower values representing greater press freedom and higher values indicating more restrictions.

The results show notable contrasts across the countries studied. The United States and China stand out as global leaders, ranking first and second, respectively, in both engagement and vibrancy, reflecting their dominant role in AI research, industry, and policy. However, their press freedom scores diverge sharply, while the U.S. maintains a mid-range position, China ranks among the lowest worldwide, suggesting a heavily constrained media environment. European countries such as Germany, France, and the United Kingdom show strong AI vibrancy rankings combined with relatively high press freedom, providing a fertile environment for diverse media narratives on AI. India ranks high in AI engagement and vibrancy but low in press freedom, which may shape the way AI discourse is reported. Russia and Brazil show weaker AI vibrancy and press freedom, though Russia's engagement rank remains relatively high. Japan and Italy occupy mid-range positions, with Japan particularly strong in economic scale and vibrancy, while Italy ranks lower on AI indicators. Overall, these contrasts highlight the interplay between structural, technological, and political contexts in shaping media coverage of AI.

The variables that have been extracted using Media Cloud API are the title of the news article, its publish date, the url to the article, the language of the article, and the media outlet name. After extracting these variables, the library newsplease was used to extract the main text of each article, which is the variable that has been used for the analysis using LLM and NLP methodologies.

Due to the limitations in the daily use of Google Gemini API, the LLM that has been selected, a random sample of 1,000 news articles for each country was utilized instead of the complete data extracted from the one-year time frame. The decision to use this sampling strategy was based on the desire to represent each country equally, thereby avoiding an overall dataset that would have had a majority of entries from one country. What follows is a table reporting the complete number of news articles extracted in the one-year time frame, the sampled number, and the used keywords.

Table 2: Number of news articles extracted in the time frame 01/06/2024 - 01/06/2025, number of sampled news articles, and version of the keyword 'artificial intelligence' used for each country.

| Country | complete number of articles (% of the total) | number of sampled articles | Keyword used |
|---------|---|-------------------------------|---------------------------|
| Brazil | 48,279 (9.4%) | 1,000 | Inteligência Artificial |
| China | 4,690 (0.9%) | 909 | 人工智能 and 人工智慧 |
| France | 8,172 (1.6%) | 1,000 | Intelligence Artificielle |

| | | | |
|----------------|-----------------|-------|----------------------------|
| Germany | 19,837 (3.8%) | 1,000 | Künstliche Intelligenz |
| India | 62,635 (12.2%) | 1,000 | Artificial Intelligence |
| Italy | 21,928 (4.3%) | 1,000 | Intelligenza Artificiale |
| Japan | 102,144 (19.8%) | 1,000 | 人工知能 |
| Russia | 7,812 (1.5%) | 1,000 | ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ |
| United Kingdom | 14,371 (2.8%) | 1,000 | Artificial Intelligence |
| United States | 224,930 (43.7%) | 1,000 | Artificial Intelligence |
| Total | 514,798 (100%) | 9,909 | |

It is possible to observe in the table that the total number of articles regarding artificial intelligence is different between countries, with the United States having the most, while China has the least. China also has an actual number of articles about AI that is below 1,000. After cleaning the base dataset by removing duplicates, missing data, and not AI-related articles, the final number of AI-related news articles is 9,909.

4. Methodology

Google Gemini 2.5 flash has been utilized to extract the frames and sentiment of the news articles' main text. This particular LLM was selected after testing several different models. Various LLMs have been downloaded from Hugging Face, a platform for developing and sharing computational tools for building applications using machine learning, and other LLMs API have been contemplated. What follows is a table of the models that were tested or contemplated.

Table 3: informations about the LLMs tested or contemplated for frame and sentiment extraction.

| Model | Token Limits & Rate Limits | Supported languages | Deployment Size / Hardware Needs | Advantages | Disadvantages |
|----------------------------------|--|--|---|---|--|
| Gemini-2.5 Flash (API) | Free tier: 250 requests per day; supports up to ~32 k tokens per input, ~8 k output | ~40+ languages via Google API | Cloud hosted; no local hardware needed | Very fast, low-latency; strong reasoning & summarization; free tier available | Daily quota caps; API only (no local model). |
| Gemini-2.0 Flash (API) | Free tier: 200 requests per day; supports up to ~32 k input tokens, ~8 k output | ~40+ languages via Google API | Cloud hosted; no local hardware needed | Multimodal support, very long contexts, stable API, free tier available. | Daily quota caps; API only (no local model). |
| Antropic Claude Sonnet 3.5 (API) | Context: up to 200k tokens; API RPS ~50 (depending on plan). | English + strong multilingual (major world langs) | API-only (Anthropic Console or via AWS, Google, OpenRouter) | Strong at reasoning and long-form text; high quality outputs | Paid for large-scale use; no local deployment; slower than Gemini on small prompts |
| Openai/GPT-4o (API) | API model; context up to 1 million tokens; high throughput, low latency; high open rate limits | English + multimodal support; broad multilingual understanding | API only; cloud-hosted | Extremely high capacity, excellent instruction-following, multimodal | Requires paid access for use; non-local |
| google/gemma-2b-it | Local only; no API rate limits; context window a few | 140+ languages (text-only) | ~4 GB (float16), runs well on Colab/GPU | Lightweight, fast, open-source, easy deployment | Smaller model, so lower accuracy, not instruction-tuned. Struggled |

| | thousand tokens | | | | with frame identification |
|--|--|--|--|--|---|
| google/gemma-3-4b-bit | Local; up to 128 K tokens context; no usage caps | 140+ languages; multimodal (text+images) | ~6–7 GB; T4 GPU possible but heavy | Massive context, multilingual, multimodal, open | Only gated access; heavy memory requirements. Struggled with frame identification |
| mistralai/Mistral-7B-Instruction-v0.1 | Local; context ~8 k tokens; no rate limits | Primarily English, with limited multilingual inputs | ~4–5 GB; runs smoothly on Colab T4 | Instruction-tuned, fast inference, clean completions. Successfully identifies frames | Smaller context, less tested outside English |
| mistralai/Mistral-8x7B-Instruction-v0.1 | Local; up to ~8–32 k tokens; no API limits | Multilingual support, built on Mistral architecture | ~7 GB; runs well in Colab with quantized layouts | Clean, modern instruction tuning with GPT-4-style performance | Experimental variants; community still adopting. Too heavy |
| deepseek-ai/DeepSeek-Im-7b-base | Local; no limits; context ~16 k tokens | English + Chinese; multilingual performance improving | ~6–8 GB; may require quantized (GGUF or GPTQ) for Colab | Good instruction tuning, strong multilingual, open-source | Slight setup complexity, community support still growing. Struggled with frame identification |
| deepseek-ai/DeepSeek-R1 | Local; MoE model; context up to ~16 k tokens; no rate limits | English + Chinese; strong reasoning and reasoning-cont tasks | Large MoE model (~7 GB+), heavy; GPTQ quantized versions may exist | Excellent reasoning, competitive with GPT-o1 in benchmarks | MoE complexity, resource-intensive, fewer deployment guides. Requires a powerful GPU |
| deepseek-ai/DeepSeek-R1-Distill-Llama-8B | Local; context up to ~32 k tokens (similar architecture as | Strong multilingual base as per Llama-3.1 | ~5 GB; runs in Colab with quantized GGUF version | Highly capable distilled reasoning and instruction following with compact size | Less widely tested; requires specific configuring. Struggled with frame identification |

| Llama-3.1, distilled) | | | | | |
|--|--|--|--|--|--|
| meta-llama/LI ama-3.1-8B-I nstruct | Local; context window up to ~131,072 tokens (8 k default output limit) | Multilingual: English, French, German, Italian, Spanish, Hindi, Thai, etc. | ~4–8 GB; large context needs more RAM; unstable on Colab | Huge context window, good multilingual coverage, instruction tuned | Heavy, slow, may require more GPU RAM than Colab offers. Struggled with frame identification |

The LLMs under payment, in this case OpenAI and Claude, were excluded due to the limited economic resources of this project. The models that were freely accessible were tested using the same prompt for classifying the frames of 70 AI-related articles' main text coming from the United Kingdom. The models that were able to output an actual result were the MistralAI model, Gemini 2.0 flash, and Gemini 2.5 flash. To decide the best one, 15 articles have been manually checked to control how many times the frame classification was correct. The MistralAI model was correct 9 times, and the Gemini 2.0 and 2.5 models were both correct 14 times, therefore, MistralAI was excluded. Given the same performance by the two Gemini models, the decision went to the one with the least restriction on use for the free tier. The deciding factor was the number of daily requests, since the token and requests per minute limits were secondary. Gemini 2.0 flash has a 200 requests per day limit, while Gemini 2.5 flash has a limit of 250 requests, therefore, the latter was chosen.

The prompt that has been used for the frame classification is the following.

"""

The following article discusses artificial intelligence (AI).

Please read the article and identify **which of the following frames apply**. You can apply only one frame, choose the most fitting. Only choose from this list:

1. AI impacts on businesses, economy, and jobs
2. AI transformations in education and research
3. AI in national security and global partnerships
4. AI disruptions in media and creative industries
5. AI-based innovative solutions
6. AI regulations, ethics, and data privacy
7. AI competition and market dynamics in tech industries
8. AI in healthcare and climate change
9. AI in politics, elections, and public opinion
10. Other
11. Not AI related

Article:

{article_text}

Instructions:

Return your answer as the name of the frame, e.g. "AI impacts on businesses, economy, and jobs".

In case of other, return "Other - name of the frame".

Do not explain your reasoning.

"""

The categories for the framing have been taken from the paper written by Ittefaq et al. (2025), because their research provided a reliable base for this frame extrapolation.

The prompt that has been used for the sentiment classification is the following.

"""

Your task is to assess the sentiment of the article below regarding artificial intelligence (AI).

Please read the article and assign a sentiment score on the following scale:

- **-5**: Extremely negative tone about AI
- **-4**: Very negative
- **-3**: Moderately negative
- **-2**: Somewhat negative
- **-1**: Slightly negative
- **0**: Neutral or balanced
- **1**: Slightly positive
- **2**: Somewhat positive
- **3**: Moderately positive
- **4**: Very positive
- **5**: Extremely positive tone about AI

Article:

{article_text}

Instructions:

Return only the sentiment score (e.g., -3). Do not explain your reasoning or include any other text.

"""

The rows that resulted in a frame not being AI-related have been removed, this way, the sample of almost 10,000 news articles is actually about AI.

For sentiment analysis, a lexicon-based approach was also applied using the VADER (Valence Aware Dictionary and sEntiment Reasoner) tool. This method relies on a predefined lexicon of words associated with positive or negative sentiment values, which are combined into a sentiment score for each text. Specifically, VADER calculates polarity scores for each article's main text, including a compound score that summarizes the overall sentiment on a continuous scale from -1 (most negative) to +1 (most positive). To align results with the sentiment classification using Gemini, this compound score was rescaled to a discrete range from -5 to +5, where negative values indicate negative sentiment, positive values indicate positive sentiment, and 0 denotes neutrality. Unlike machine learning models, this lexicon-based method does not require training data and provides an interpretable, rule-based assessment of sentiment directly from word usage patterns.

From the 9,909 news articles, 100 have been randomly sampled for a manual check of the frame and sentiment. The sample was composed of 10 random rows for each country, to ensure representability. The articles not in English have been translated using Google Translate into English.

Table 4: Number of correctly assigned frames and sentiment using Gemini and Vader.

| Country | number of correctly assigned frames (Gemini) | number of correctly assigned sentiment (Gemini) | number of correctly assigned sentiment (VADER) |
|----------------|---|--|---|
| Brazil | 8/10 | 9/10 | 2/10 |
| China | 8/10 | 10/10 | 1/10 |
| France | 8/10 | 10/10 | 3/10 |
| Germany | 8/10 | 9/10 | 3/10 |
| India | 7/10 | 8/10 | 5/10 |
| Italy | 10/10 | 10/10 | 7/10 |
| Japan | 10/10 | 10/10 | 4/10 |
| Russia | 10/10 | 9/10 | 3/10 |
| United Kingdom | 9/10 | 10/10 | 4/10 |
| United States | 8/10 | 9/10 | 4/10 |
| Total | 86/100 | 94/100 | 36/100 |

Looking at the table, it is possible to see that the result for Gemini is 86 correct frame assignments and 94 correct sentiment assignments. On the other hand, VADER performed poorly. The performance of these models has been consistent across the different languages and countries, except for the good performance of VADER on the Italian sample. Given these results, it can be assert that VADER, a lexicon-based method, is not reliable for providing the sentiment of multilingual news articles' text.

For the topic modeling task, BERTopic has been applied, a transformer-based topic modeling technique, to the cleaned text of the 9.909 news articles. Specifically, the content has been extracted from the main text field of the dataset, preprocessed by converting all text to lowercase, removing non-alphabetical characters, and filtering out stopwords, in order to retain only the most meaningful words. BERTopic leverages transformer embeddings to represent each document in a high-dimensional semantic space and then applies dimensionality reduction (UMAP) followed by clustering (HDBSCAN) to group similar articles into coherent topics. Each topic is represented by its most frequent and representative words, from which it was manually assigned descriptive topic names. This approach allows topics to emerge inductively from the data, without predefined labels, providing an additional

lens for understanding the themes present in media coverage of AI. By applying the same procedure across countries, comparable sets of topics that highlight both cross-national similarities and differences in how AI is discussed in the media have been generated.

To evaluate the feasibility of predicting media frames and sentiment using traditional natural language processing (NLP) methods, supervised machine learning models were trained on the labeled dataset. The labels for frames and sentiment were derived from large language model (LLM) annotations, which served as a reliable ground truth. The articles' main texts were transformed into numerical features through TF-IDF vectorization, capturing the relative importance of words across documents while reducing the influence of frequent terms. For frame prediction, two classifiers were applied: logistic regression, which offers a linear baseline with interpretable coefficients, and random forest, which introduces non-linear decision boundaries and robustness through ensemble averaging. For sentiment prediction, the task was treated as a regression problem due to the continuous scale of sentiment values ranging from -5 to $+5$. Linear regression provided a straightforward baseline, while random forest regressor captured complex non-linear relationships between textual features and sentiment scores. Separate models were trained for each country, with independent experiments for both frames and sentiment. Model performance was assessed on held-out test sets, classification was evaluated using precision, recall, and F1-scores, while regression was evaluated using mean squared error (MSE), mean absolute error (MAE), and the coefficient of determination (R^2). This approach enabled benchmarking the predictive capacity of classical NLP pipelines across countries.

5. Results

This section presents the findings in three parts: the topic modeling results, the frame and sentiment analysis, and the predictive models performance using traditional NLP techniques.

5.1. Topic modeling

The topic modeling results using BERTopic are being displayed in the following table.

Table 5: Topic modeling results for each country using BertTopic

| Country | Articles | Topic name | Representation words |
|---------|----------|----------------------------------|--|
| Brazil | 320 | AI in Education & Business Use | 'ai', 'technology', 'intelligence', 'artificial', 'companies', 'beyond', 'about', 'education', 'can', 'brazil' |
| | 243 | AI in Brazilian Politics | "brazil", 'about', 'intelligence', 'artificial', 'president', 'ai', 'said', 'data', 'lula', 'content' |
| | 217 | General AI Discussions in Brazil | 'intelligence', 'artificial', 'ai', 'about', 'use', 'can', 'technology', 'brazil', 'beyond', 'said' |

| | | | |
|---------|-----|---|--|
| | 147 | Elections & AI | 'votes', 'quotient', 'elected', 'electoral', 'candidates', 'valid', 'mayors', 'party', 'tse', 'parties' |
| | 73 | AI & Global Tech Competition | 'ai', 'deepseek', 'china', 'us', 'company', 'chips', 'usa', 'billions', 'technology', 'nvidia' |
| China | 636 | Military, Government, and Five-Year Plans | 'In recent years', 'Reporter', 'People's Liberation Army Daily reporter', 'Nowadays', '14th Five-Year Plan', 'Wu Qian', 'Not long ago', 'Click on the image to view the product', 'Last year', 'Recently' |
| | 273 | AI and Belt & Road Projects / Institutional Announcements | 'Xinhua News Agency reporter', '100 million yuan', 'One Belt, One Road', 'Editor', 'Project', 'Author', 'Account', 'Publisher', 'Main creator', 'Awards' |
| France | 809 | General Discourse on AI | 'AI', 'plus', 'intelligence', 'this', 'artificial', 'like', 'also', 'be', 'all', 'if' |
| | 78 | Apple and AI Integration | 'Apple', 'iPhone', 'Pro', 'Plus', 'intelligence', 'AI', 'iOS', 'this', 'Siri', 'like' |
| | 62 | Samsung & Smartphone Market | 'Galaxy', 'Samsung', 'price', 'euros', 'plus', 'Pro', 'screen', 'offer', 'Smartphone', 'Black' |
| | 38 | Consumer Products & Promotions | 'this', 'article', 'location', 'price', 'discover', 'offer', 'here', 'ninja', 'moment', 'euros' |
| | 13 | Stock Market & AI-related Financial Trends | 'index', 'after', 'rise', 'dow', 'towards', 'Chinese', 'AI', 'Alibaba', 'Jones', 'billions' |
| Germany | 957 | AI, Politics & Economy | 'AI', 'intelligence', 'more', 'artificial', 'percent', 'US', 'company', 'Trump', 'be', 'people' |
| | 43 | AI in News and Marketing | 'AI', 'percent', 'ad', 'it', 'close', 'editorially', 'before', 'translated', 'article', 'reviewed' |
| India | 747 | AI Development in India | 'ai', 'india', 'said', 'also', 'new', 'technology', 'intelligence', 'artificial', 'us', 'data' |
| | 223 | AI in Markets and Industry | 'ai', 'said', 'market', 'also', 'data', 'crore', 'google', 'artificial', 'stock', 'intelligence' |

| | | | |
|--------|-----|---|---|
| | 30 | AI in Cybersecurity & Digital Governance | 'ai', 'security', 'said', 'cyber', 'india', 'governance', 'digital', 'fraud', 'cybersecurity', 'data' |
| Italy | 812 | AI in Italy | 'intelligence', 'artificial', 'ai', 'italy', 'world', 'being', 'data', 'only', 'work', 'president' |
| | 96 | Apple & Global AI Narratives | 'apple', 'intelligence', 'artificial', 'state', 'being', 'world', 'only', 'when', 'can', 'ai' |
| | 92 | AI in Healthcare & Diagnostics | 'patients', 'intelligence', 'artificial', 'research', 'patient', 'healthcare', 'medicine', 'diagnosis', 'university', 'doctors' |
| Japan | 627 | Corporate Applications of AI | 'AI', 'Corporation', 'company', 'service', 'development', 'utilization', 'data', 'https', 'business', 'able' |
| | 196 | AI in Business and Subsidized Innovation | 'AI', 'https', 'business', 'for', 'technology', 'possible', 'support', 'com', 'able', 'Corporation' |
| Russia | 147 | AI Potentials and Societal Impact | 'AI', 'for', 'becoming', 'becoming', 'those', 'will be', 'possible', 'yes', 'can', 'can' |
| | 30 | Markets, Investment & Semiconductors | 'market', 'dollar', 'investment', 'semiconductor', 'Japan', 'index', 'China', 'company', 'rise', 'stock' |
| | 359 | General AI Terminology & Development | 'this', 'and', 'intelligence', 'artificial', 'also', 'which', 'year', 'intelligence', 'artificial', 'year' |
| Russia | 337 | AI in Russian Political Discourse | 'this', 'Russia', 'also', 'year', 'intelligence', 'artificial', 'which', 'year', 'Putin', 'time' |
| | 185 | AI and Companies / Technology Development | 'and', 'this', 'intelligence', 'artificial', 'intelligence', 'artificial', 'also', 'companies', 'which', 'technologies' |
| | 52 | AI-related Fraud & Scams | 'this', 'TASS', 'fraudsters', 'fraudsters', 'which', 'citizens', 'Kondrashov', 'year', 'also', 'Andrey' |

| | | | |
|----------------|-----|---------------------------------|---|
| | 35 | AI in Healthcare & Patient Data | 'and', 'this', 'patients', 'data', 'healthcare', 'doctor', 'also', 'artificial', 'intelligence', 'doctor' |
| | 32 | AI in Drones & Military Systems | 'and', 'this', 'drones', 'intelligence', 'artificial', 'drones', 'systems', 'including', 'which', 'also' |
| United Kingdom | 442 | AI in Academia & Research | 'ai', 'said', 'university', 'year', 'new', 'also', 'one', 'uk', 'us', 'intelligence' |
| | 190 | AI Business & Market Growth | 'market', 'ai', 'global', 'growth', 'data', 'us', 'technology', 'business', 'solutions', 'industry' |
| | 66 | AI in Healthcare & Medicine | 'healthcare', 'cancer', 'market', 'health', 'disease', 'patients', 'research', 'medical', 'ai', 'treatment' |
| | 64 | AI in Creative Industries | 'ai', 'said', 'music', 'copyright', 'film', 'like', 'creative', 'uk', 'song', 'year' |
| | 56 | AI & Politics | 'trump', 'musk', 'said', 'president', 'would', 'openai', 'harris', 'company', 'ai', 'us' |
| | 55 | AI & Humanity | 'ai', 'human', 'people', 'could', 'said', 'technology', 'world', 'like', 'one', 'intelligence' |
| | 46 | UK Politics & AI | 'labour', 'government', 'said', 'people', 'nhs', 'keir', 'minister', 'new', 'sir', 'work' |
| | 44 | AI & Consumer Tech | 'apple', 'iphone', 'pro', 'new', 'features', 'galaxy', 'samsung', 'intelligence', 'ai', 'phone' |
| | 37 | AI & Online Safety | 'children', 'images', 'said', 'abuse', 'people', 'online', 'young', 'women', 'ai', 'child' |
| United States | 251 | General AI News & Consumer Tech | 'said', 'ai', 'new', 'also', 'year', 'apple', 'one', 'company', 'like', 'intelligence' |
| | 227 | Human-Centered AI & OpenAI | 'ai', 'said', 'like', 'data', 'new', 'also', 'human', 'intelligence', 'openai', 'one' |
| | 158 | AI & Stock Market | 'said', 'nvidia', 'year', 'ai', 'company', 'market', 'billion', 'quarter', 'china', 'stock' |

| | | |
|-----|--|---|
| 150 | Financial Ratios & Stock Market Analysis | 'ratio', 'stock', 'company', 'dividend', 'price', 'earnings', 'marketbeat', 'news', 'days', 'short' |
| 128 | AI & Politics | 'said', 'trump', 'ai', 'president', 'would', 'bill', 'state', 'biden', 'house', 'election' |
| 50 | AI in Medical/Healthcare Companies | 'ratio', 'medical', 'company', 'stock', 'health', 'earnings', 'price', 'news', 'marketbeat', 'days' |
| 36 | AI, Energy & Climate | 'energy', 'power', 'said', 'electricity', 'nuclear', 'data', 'coal', 'climate', 'centers', 'trump' |

The BERTopic analysis revealed both cross-national similarities and country-specific variations in how artificial intelligence is discussed across news media. Overall, the model successfully extracted coherent clusters of semantically related words from the main text of articles, enabling the identification of dominant thematic areas without the need for predefined labels. Several recurrent topics emerged across countries, most notably AI's role in business, technological development, and governance, along with education, healthcare, and politics.

In the United Kingdom and United States, topics were diverse and sector-specific, including AI in academia and research, business and market growth, creative industries, and healthcare. These findings align with broader English-language media trends emphasizing innovation and ethical or labor-related implications. France and Italy showed substantial attention to consumer technology, particularly around companies such as Apple and Samsung, reflecting a focus on AI's integration into everyday products. Germany exhibited a concentration of coverage around AI's intersection with politics and the economy, consistent with the country's policy-oriented media landscape.

In Brazil and India, AI discourse was often tied to economic modernization, education, and government initiatives, while Russia and China displayed strong alignment with state narratives, including national security, infrastructure, and industrial development. In China, for instance, frequent mentions of the Belt and Road Initiative and Five-Year Plans highlight how AI is situated within state-led modernization strategies. Japan's topics, in turn, focused on corporate applications and industrial innovation, consistent with the country's business-oriented technology reporting.

Quantitatively, the largest topics in each country corresponded to general discussions about AI's technological potential and national development, showing that AI remains predominantly covered as a driver of progress rather than a subject of ethical or regulatory concern. Nonetheless, smaller clusters, such as AI-related frauds in Russia, AI for climate in the USA, or online safety and child protection in the UK, indicate the presence of emerging issue-specific narratives.

Overall, BERTopic proved effective in uncovering latent themes across multilingual datasets, illustrating how the framing of AI varies by linguistic and cultural context. While many countries share a focus on economic and technological potential, local political and media structures shape the specific narratives that dominate AI discourse.

5.2. Frame and sentiment analysis

A series of figures will now be shown to display the frame and sentiment frequencies across countries and over time.

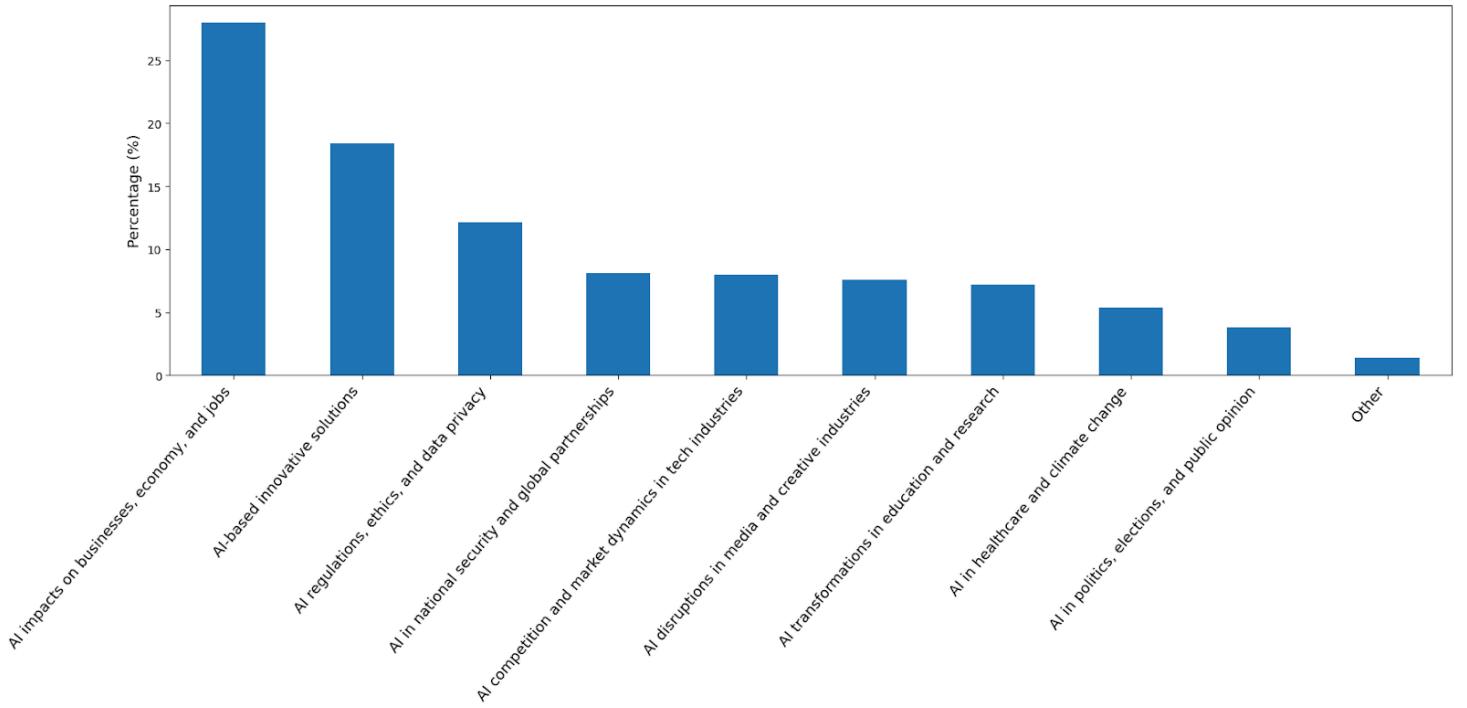


Figure 1: Frame frequencies displayed as percentage over the total.

Figure 1 illustrates the relative prominence of each thematic frame across the entire corpus, showing the percentage of articles associated with each. The distribution reveals that media attention on AI is uneven, with a few dominant narratives accounting for most of the coverage and several more specialized frames appearing less frequently.

The most prevalent frame is “AI impacts on businesses, economy, and jobs” (27.9%), which alone represents over a quarter of all articles. This indicates that economic and labor-oriented discourses form the core of how AI is portrayed in the media, emphasizing productivity gains, automation, competitiveness, and the transformation of work. The prominence of this frame reflects the economic centrality of AI in both public debate and policy discussions.

The second most frequent frame, “AI-based innovative solutions” (18.4%), also commands substantial attention, pointing to a strong narrative of technological optimism. Media often emphasize AI’s potential to solve complex problems, boost efficiency, and generate innovation across industries. Together, these two frames account for nearly half of

all coverage, underscoring a prevailing focus on AI's functional and opportunity-driven dimensions rather than its risks.

The next most common category, “AI regulations, ethics, and data privacy” (12.2%), introduces a critical and governance-oriented perspective. This suggests that while economic optimism dominates, ethical and legal concerns still occupy a meaningful share of the discourse. It reflects growing public awareness and policy debate about AI accountability, data protection, and fairness.

A middle tier of frames, “AI in national security and global partnerships” (8.1%), “AI competition and market dynamics in tech industries” (8.0%), and “AI disruptions in media and creative industries” (7.6%), represents geopolitical and sector-specific interests. These frames highlight how AI is increasingly viewed as a strategic asset influencing international relations, industry competition, and creative sectors. Their similar proportions suggest a diversified but secondary layer of discussion focused on power, innovation races, and societal adaptation.

“AI transformations in education and research” (7.2%) and “AI in healthcare and climate change” (5.4%) appear less frequently but signal the emerging coverage of AI’s social and scientific applications. These topics often carry a positive tone, associated with progress and knowledge advancement, though their lower frequency implies that public discourse still prioritizes economic and ethical narratives over socially beneficial ones.

The “AI in politics, elections, and public opinion” frame (3.8%) and “Other” (1.4%) are the least frequent, suggesting that issues related to governance or peripheral topics receive comparatively little attention. This underrepresentation may indicate that the political implications of AI, though increasingly discussed in expert and academic circles, remain marginal in mainstream media coverage.

Overall, Figure 1 reveals a strong thematic imbalance in how AI is framed publicly. Coverage is dominated by economic, innovation, and ethical frames, while social, environmental, and political dimensions occupy a smaller share. This distribution suggests that the media predominantly present AI as an engine of progress and competition, with less consistent engagement in discussions about societal impact, governance, and democratic accountability.

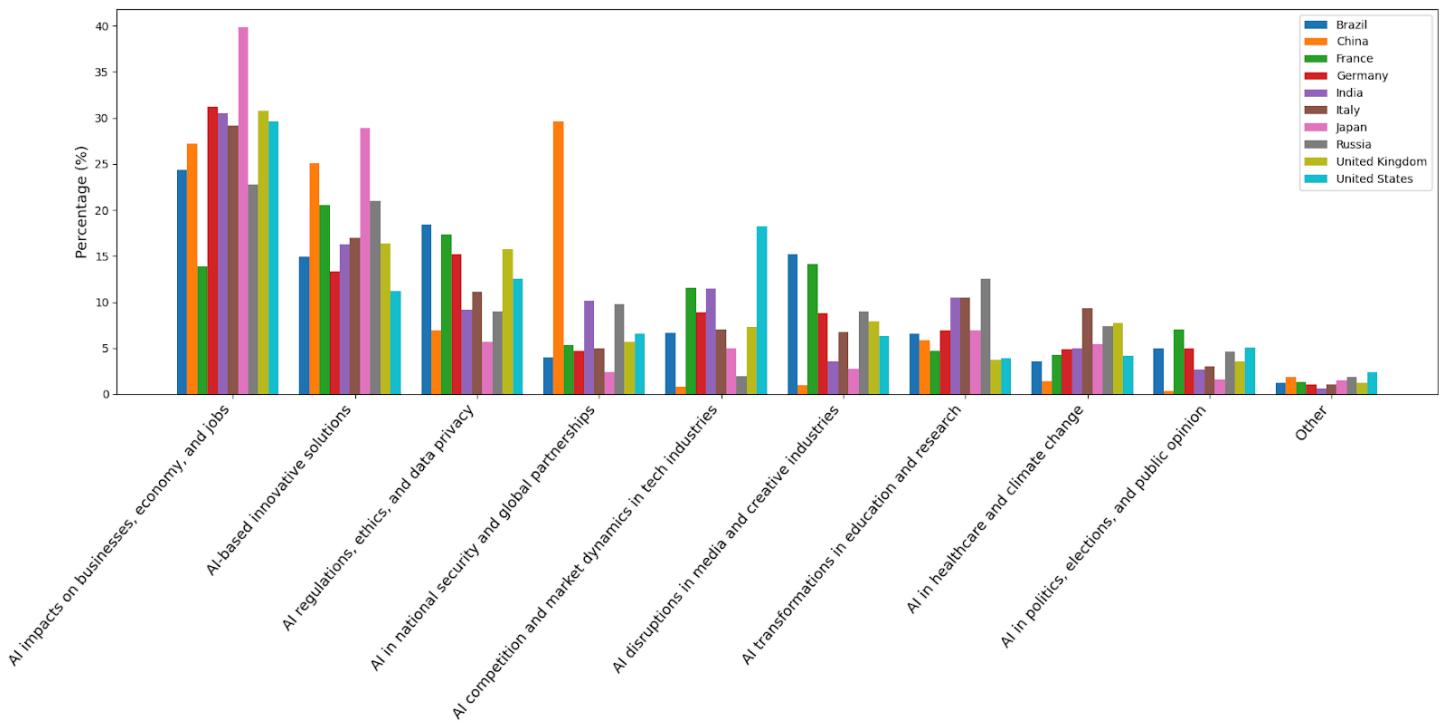


Figure 2: Frame frequencies by country displayed as percentage over the total.

Figure 2 presents the distribution of AI-related frames by country, showing how media in different national contexts prioritize specific narratives about artificial intelligence. While the overall global pattern seen in Figure 1 persists, emphasizing economic, innovation, and regulatory perspectives, there are clear cross-country variations that reveal distinctive national emphases and framing priorities.

Across nearly all countries, “AI impacts on businesses, economy, and jobs” is the most frequent frame, confirming the economic centrality of AI discourse worldwide. This frame is especially dominant in Japan (39.8%), Germany (31.2%), India (30.5%), and the United Kingdom (30.8%), suggesting a strong association between AI and productivity, automation, and competitiveness in their media ecosystems. Countries such as Italy (29.2%) and the United States (29.6%) also show similar patterns, highlighting a broadly shared economic optimism and focus on market transformation.

The “AI-based innovative solutions” frame ranks second in most contexts but shows notable variation in intensity. It is particularly prominent in Japan (28.9%) and China (25.1%), where narratives of technological leadership and innovation are central to national identity and policy agendas. In contrast, countries like the United States (11.2%) and Germany (13.3%) feature this frame less prominently, possibly reflecting a diversified technological discourse rather than one dominated by novelty.

The “AI regulations, ethics, and data privacy” frame shows regional asymmetries. It reaches higher levels in Brazil (18.4%), France (17.3%), and the United Kingdom (15.7%), suggesting that these countries are more preoccupied with governance, transparency, and social responsibility in AI. In contrast, China (6.9%) and Japan (5.7%) devote relatively little coverage to ethical regulation, likely reflecting differences in political priorities and media framing traditions.

The “AI in national security and global partnerships” frame displays extreme variation. It is exceptionally prominent in China (29.6%), where AI is frequently discussed in strategic and geopolitical terms, emphasizing international competition and state power. Other countries, such as India (10.1%), Russia (9.8%), and the United States (6.6%), also engage with this frame, although at lower levels, often in relation to global tech rivalry or defense innovation. In contrast, Japan (2.4%) and France (5.3%) allocate relatively little attention to this dimension.

The “AI competition and market dynamics in tech industries” frame reveals important geopolitical and economic differences. It reaches its highest prominence in the United States (18.2%), emphasizing the competitive and corporate rivalry dimension of AI among major tech firms. India (11.5%) and France (11.6%) also highlight this frame, possibly reflecting domestic efforts to position themselves within global technology markets. Meanwhile, Germany (8.9%) and the United Kingdom (7.3%) show moderate engagement, consistent with their role as advanced but regulation-oriented economies. By contrast, China (0.8%) and Japan (5.0%) display low attention to this frame, likely because competition narratives in their media are often reframed through national innovation or state-led industrial policy, rather than market rivalry.

Frames focusing on specific sectors, such as “AI disruptions in media and creative industries”, “AI transformations in education and research”, and “AI in healthcare and climate change”, tend to occupy a secondary but stable share, roughly between 4.0% and 15.0%. For instance, France (14.1%) and Brazil (15.2%) show a relatively high interest in AI’s impact on creative sectors, while Italy (10.5%), India (10.5%), and Russia (12.5%) emphasize its educational and research transformations. The healthcare and climate frame is most visible in Italy (9.3%) and Russia (7.4%), pointing to national sensitivities to applied and socially beneficial technologies.

By contrast, the “AI in politics, elections, and public opinion” frame remains consistently marginal across all contexts, ranging from only 0.3% in China to about 7% in France, indicating that the political and democratic implications of AI are underrepresented globally. Similarly, the “Other” category rarely exceeds 2.0%, reflecting that most AI-related discourse fits into a few dominant interpretive frames.

Overall, Figure 2 reveals a dual structure of global and national framing. On the one hand, countries converge on an economic, innovation, and ethics triad that dominates global AI narratives. On the other, they diverge in emphasis, China and Japan prioritize innovation and security, European countries highlight regulation and social responsibility, India and Brazil combine economic and developmental concerns, while the United States balances economic and competitive narratives. These differences underscore how media framing reflects national policy priorities, economic structures, and public attitudes toward technology.



Figure 3: “AI impacts on businesses, economy, and jobs” frame monthly frequency over time by country, represented as percentage over the total.

Figure 3 illustrates the evolution of the “AI impacts on businesses, economy, and jobs” frame from June 2024 to May 2025 across the ten analyzed countries, expressed as the proportion of total frames occurrences. Overall, the figure reveals moderate temporal fluctuations, with most countries showing increased attention to the economic implications of AI at the beginning of 2025.

Brazil and India displayed relatively stable coverage throughout the period, oscillating between 1.5% and 3.5% of total frames, with modest peaks in January and May 2025, respectively, suggesting a consistent integration of economic narratives within national AI discourse. In China, the frame remained marginal during most of 2024 but rose sharply in early 2025, peaking in March (5.1%), possibly reflecting heightened media focus on AI-driven industrial or policy developments.

European countries such as France, Germany, and Italy exhibited a more pronounced upward trend toward late 2024, particularly in November and December, followed by higher frequencies in the first quarter of 2025. Italy, in particular, reached one of the highest shares in May 2025 (3.8%), indicating growing media interest in AI’s contribution to productivity and competitiveness.

Japan maintained one of the most consistently high levels across the entire period, ranging from 2.2% to 4.6%, with a gradual upward trajectory culminating in March 2025, in line with the country’s industrial emphasis on AI and automation. In contrast, Russia’s coverage showed a gradual decline after mid-2024, stabilizing below 2.0% in 2025, perhaps reflecting a lower prioritization of economic narratives in national reporting.

The United Kingdom and the United States followed similar dynamics, with limited coverage during mid-2024 and notable increases in January 2025, with 4.0% for UK and 4.3% for US, coinciding with the global wave of attention following new AI product launches and regulatory debates.

Altogether, the temporal pattern suggests that discussions on AI’s economic and labor market impacts tend to intensify in response to major technological or policy developments, revealing the responsiveness of media framing to global AI-related events.

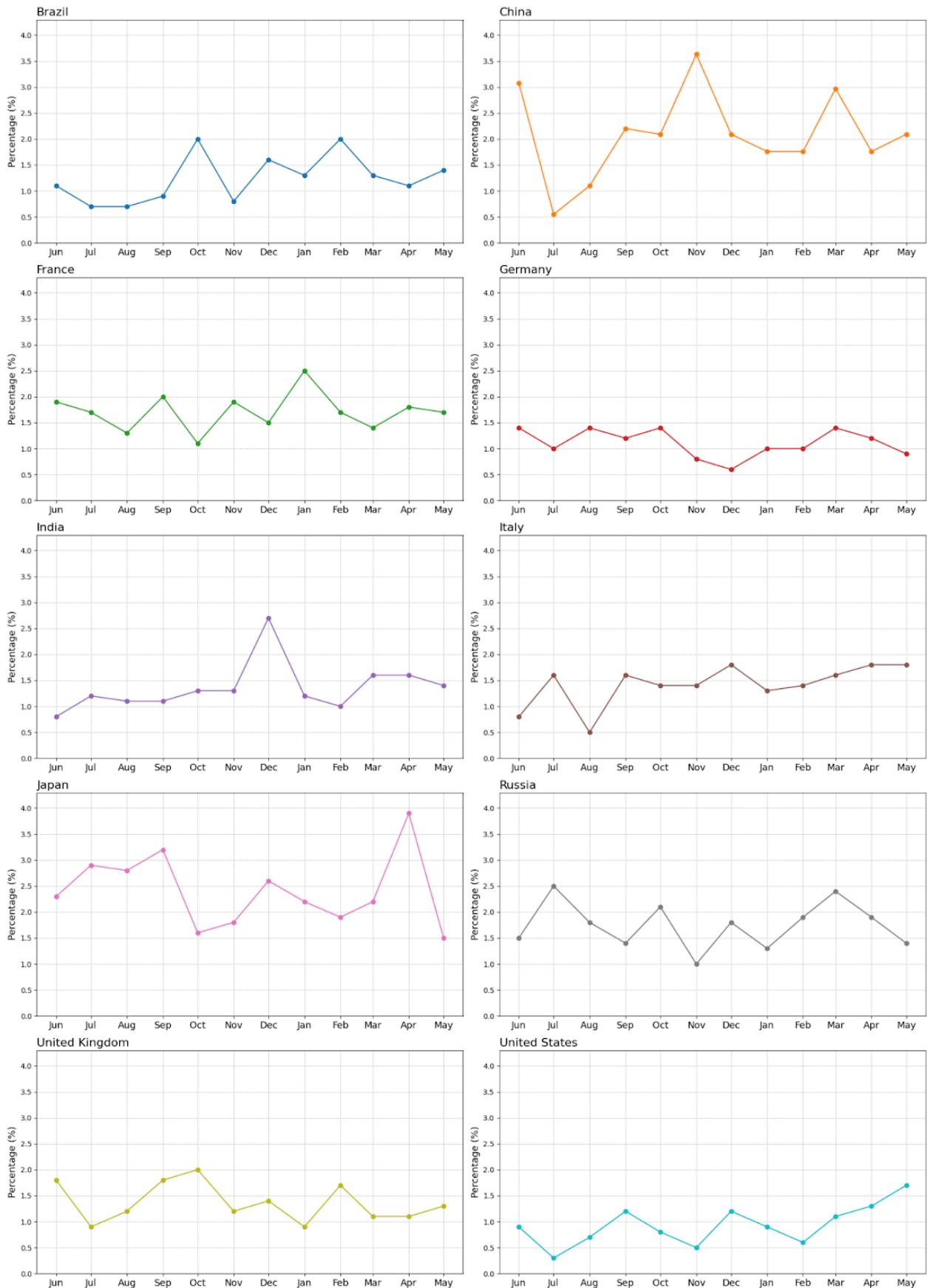


Figure 4: “AI-based innovative solutions” frame monthly frequency over time by country, represented as percentage over the total.

Figure 4 illustrates the evolution of the “AI-based innovative solutions” frame across the ten analyzed countries from June 2024 to May 2025, showing the proportion of innovation-oriented narratives relative to total frames counts. Overall, the prominence of this frame remains moderate in most contexts, with small but notable peaks that likely correspond to announcements of new AI technologies or product applications.

In Brazil, the coverage fluctuated between 0.7% and 2.0%, with a mild increase in October 2024 and February 2025, possibly linked to discussions on domestic AI adoption and entrepreneurship. China exhibited higher volatility and overall higher values than most countries, with distinct surges in June and November 2024, over 3.0%, and again in March 2025, reflecting state-driven initiatives and media attention to AI innovation within national development strategies.

France and Germany showed more stable patterns, generally oscillating around 1.0–2.0%, consistent with steady but not dominant engagement in innovation discourses within broader AI reporting. In India and Italy, the frame gained slightly more attention toward late 2024, with December and early 2025 showing mild peaks, suggesting an increased focus on the local implementation of AI technologies in business and governance.

Japan maintained one of the highest and most consistent frequencies, between 2.0% and 3.0%, with a pronounced rise in April 2025 (3.9%), indicative of sustained public interest in technological advancement. Russia and the United Kingdom displayed relatively stable trends, with values generally below 2.0%, though occasional short-term increases hint at episodic coverage tied to specific developments or events.

In contrast, the United States showed the lowest overall levels, remaining mostly below 1.5%, which may suggest that innovation is more often embedded within economic or policy frames in American media rather than treated as a standalone theme.

Overall, the figure reveals that while the “AI-based innovative solutions” frame appears across all national contexts, its salience tends to rise temporarily in correspondence with major technological announcements or domestic policy debates, underscoring the reactive nature of media attention to AI-driven innovation.

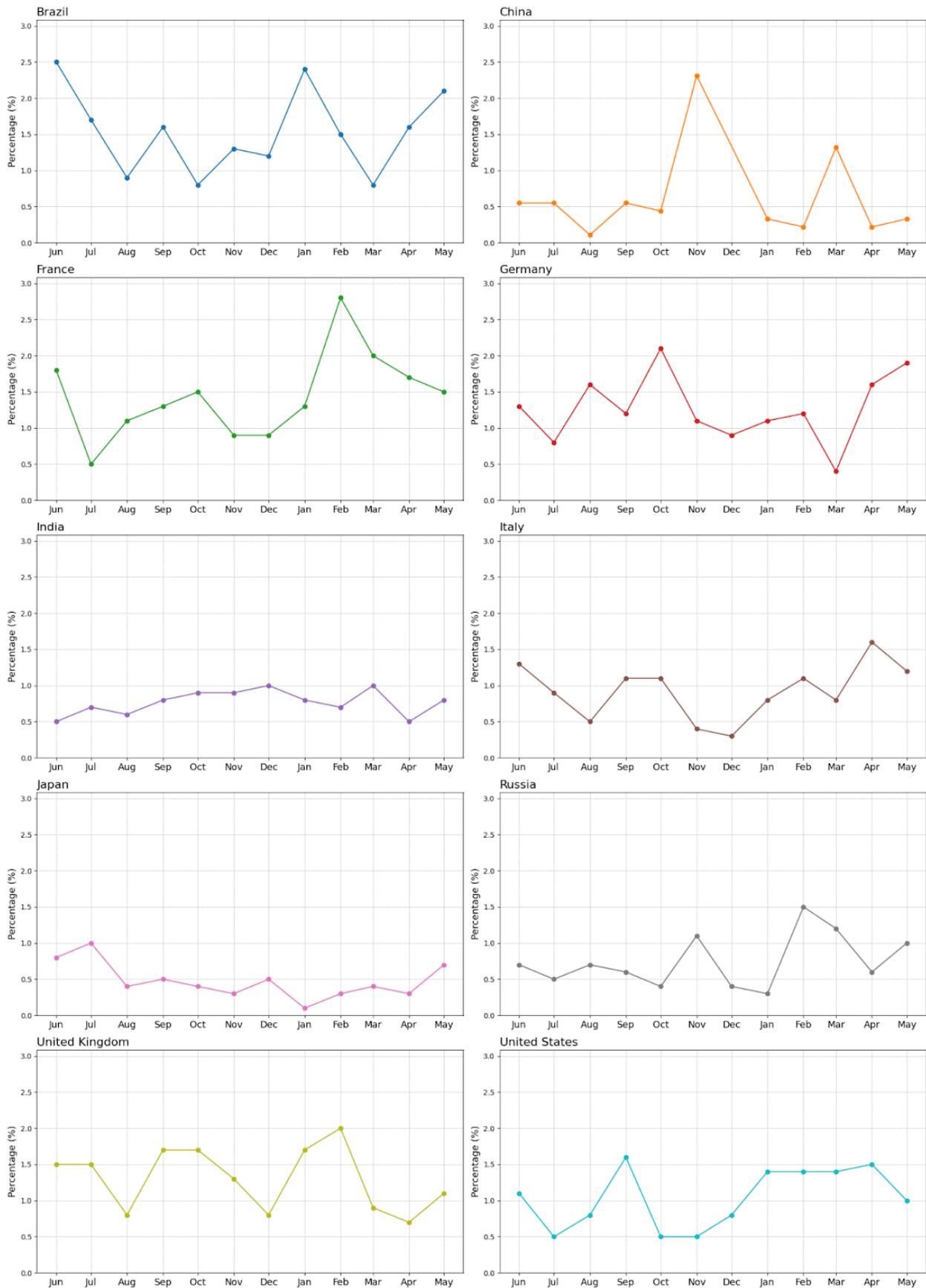


Figure 5: “AI regulations, ethics, and data privacy” frame monthly frequency over time by country, represented as percentage over the total.

Figure 5 presents the temporal distribution of the “AI regulations, ethics, and data privacy” frame from June 2024 to May 2025, illustrating the relative salience of governance and ethics-oriented narratives in AI coverage across countries. Overall, this frame appears less dominant than those focused on economic or technological innovation, suggesting that regulatory and ethical considerations receive intermittent rather than sustained attention in global media.

In Brazil, coverage fluctuates between 0.8% and 2.5%, peaking in June 2024 and January 2025 periods, likely linked to national policy debates or legislative developments around AI governance. China shows very low but sharply episodic attention, with small peaks in November 2024 and March 2025, above 2.0%, possibly reflecting top-down state announcements or international regulatory discussions covered by Chinese outlets.

France demonstrates one of the most consistent patterns, with relatively stable values between 1.0% and 2.0% and a clear increase in February and March 2025, aligning with European discussions on the implementation of the EU AI Act. Similarly, Germany shows moderate fluctuations, reaching its highest point in October 2024 (2.1%) and maintaining steady engagement through 2025, suggesting continued domestic interest in data privacy and AI oversight.

In contrast, India and Italy record more subdued frequencies, generally below 1.0%, indicating that ethical and privacy considerations remain secondary compared to narratives emphasizing economic potential or digital transformation.

Japan exhibits the lowest overall coverage levels, rarely exceeding 1.0%, which may reflect a stronger media focus on AI’s practical applications rather than its governance challenges. Russia also shows limited but slightly increasing attention in early 2025, potentially tied to state communication around cybersecurity or information regulation.

In the United Kingdom and the United States, interest in AI regulation and ethics is more consistent and slightly higher on average, with values fluctuating around 1.0–2.0%. The UK shows visible peaks in early 2025, coinciding with policy discourse surrounding AI safety summits and government consultations, while the U.S. displays a similar trend, peaking in early 2025 during renewed debates over federal AI oversight and data protection.

Taken together, the trends in Figure 5 highlight that regulatory and ethical narratives remain a recurrent but secondary component of AI media coverage. Peaks in attention tend to coincide with specific policy events or institutional announcements rather than long-term reporting trends. This cross-country pattern suggests that while AI ethics and data governance are universally recognized concerns, they still occupy a reactive, event-driven position in the broader media discourse on artificial intelligence.

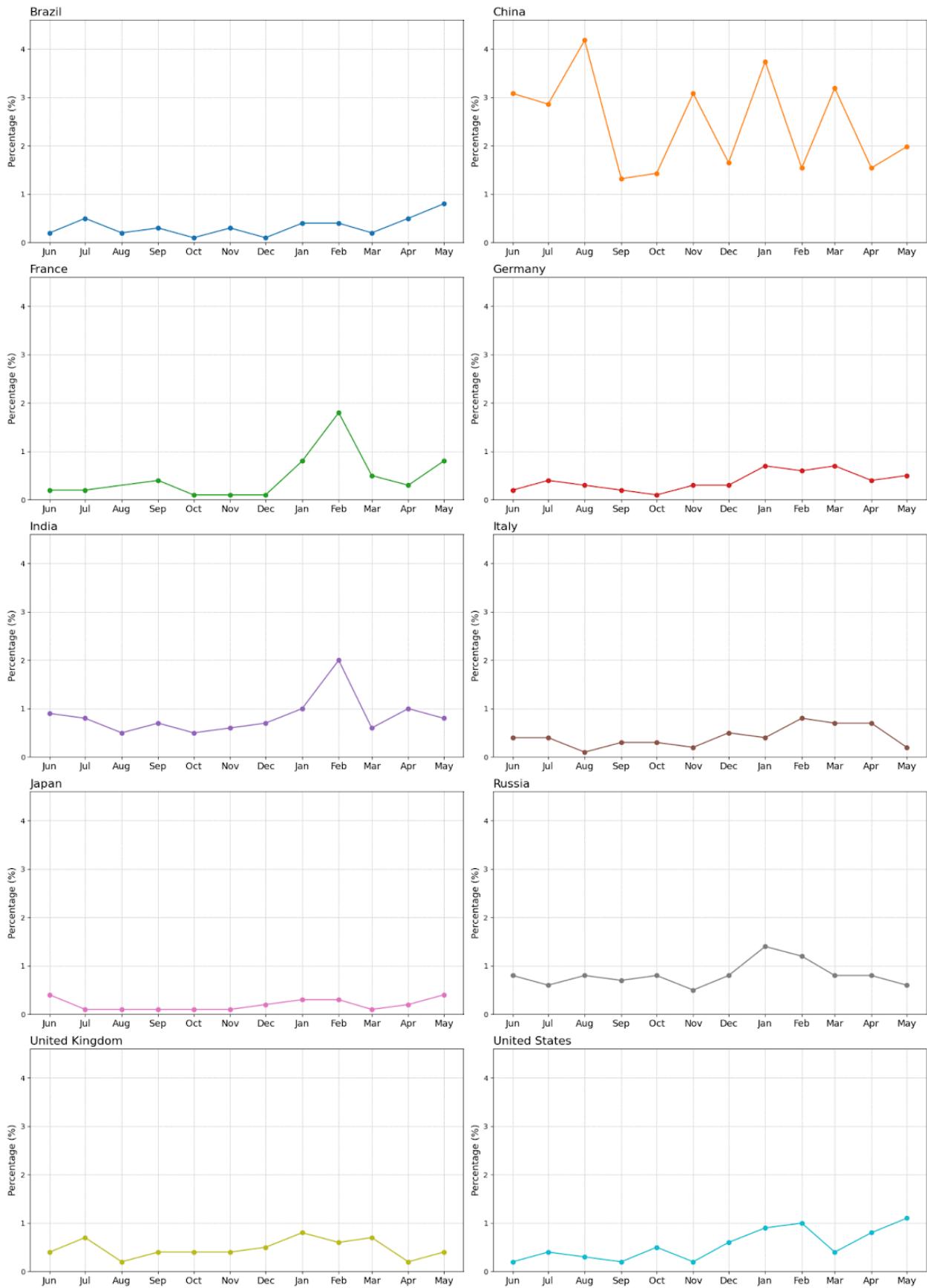


Figure 6: “AI in national security and global partnerships” frame monthly frequency over time by country, represented as percentage over the total.

Figure 6 illustrates the monthly evolution of the “AI in national security and global partnerships” frame between June 2024 and May 2025, showing how the intersection of artificial intelligence with defense, geopolitical competition, and international cooperation has been represented in global media. Across countries, this frame appears relatively infrequent overall, reflecting the specialized and often policy-driven nature of security-related reporting on AI. However, important national variations emerge.

China stands out with substantially higher and more volatile coverage, peaking at over 4.0% in August 2024 and maintaining several subsequent surges between November 2024 and March 2025. This pattern suggests that Chinese media have actively connected AI to military modernization, dual-use technologies, and international initiatives such as the Belt and Road, consistent with the state’s emphasis on AI as a pillar of strategic competitiveness.

In contrast, most other countries exhibit much lower and more stable levels of attention. Brazil, for example, maintains frequencies below 1.0% throughout the period, with a modest rise in May 2025, likely reflecting episodic mentions of AI within foreign policy or defense cooperation contexts rather than sustained discourse.

Similarly, European countries such as France, Germany, and Italy show minor fluctuations, with temporary peaks in early 2025, possibly linked to European Union deliberations on technological sovereignty and defense applications of AI. India shows a mild but noticeable spike in February 2025 (2.0%), potentially associated with its growing involvement in global AI partnerships and concerns about cybersecurity and defense modernization.

Russia maintains a relatively steady engagement, around 0.5–1.4%, indicating a consistent narrative associating AI with military and surveillance capabilities, in line with its national security rhetoric.

Japan, the United Kingdom, and the United States show limited yet noticeable increases in early 2025, aligning with global conversations on AI safety and international cooperation initiatives, such as the AI Safety Summit and bilateral agreements on responsible AI use in defense. However, their overall coverage remains low, suggesting that while the strategic implications of AI are recognized, they occupy a niche within broader media attention dominated by economic and societal frames.

Overall, Figure 6 underscores how the national security and global partnerships frame remains peripheral yet strategically significant in AI media coverage. Peaks in attention tend to coincide with major geopolitical or policy events rather than continuous reporting, highlighting the reactive, event-driven nature of this narrative. The stark contrast between China’s sustained engagement and other countries’ sporadic coverage points to a divergent framing dynamic, where AI is primarily a tool of strategic power in state-driven media systems but remains a secondary topic in liberal media landscapes focused on regulation, economy, and ethics.

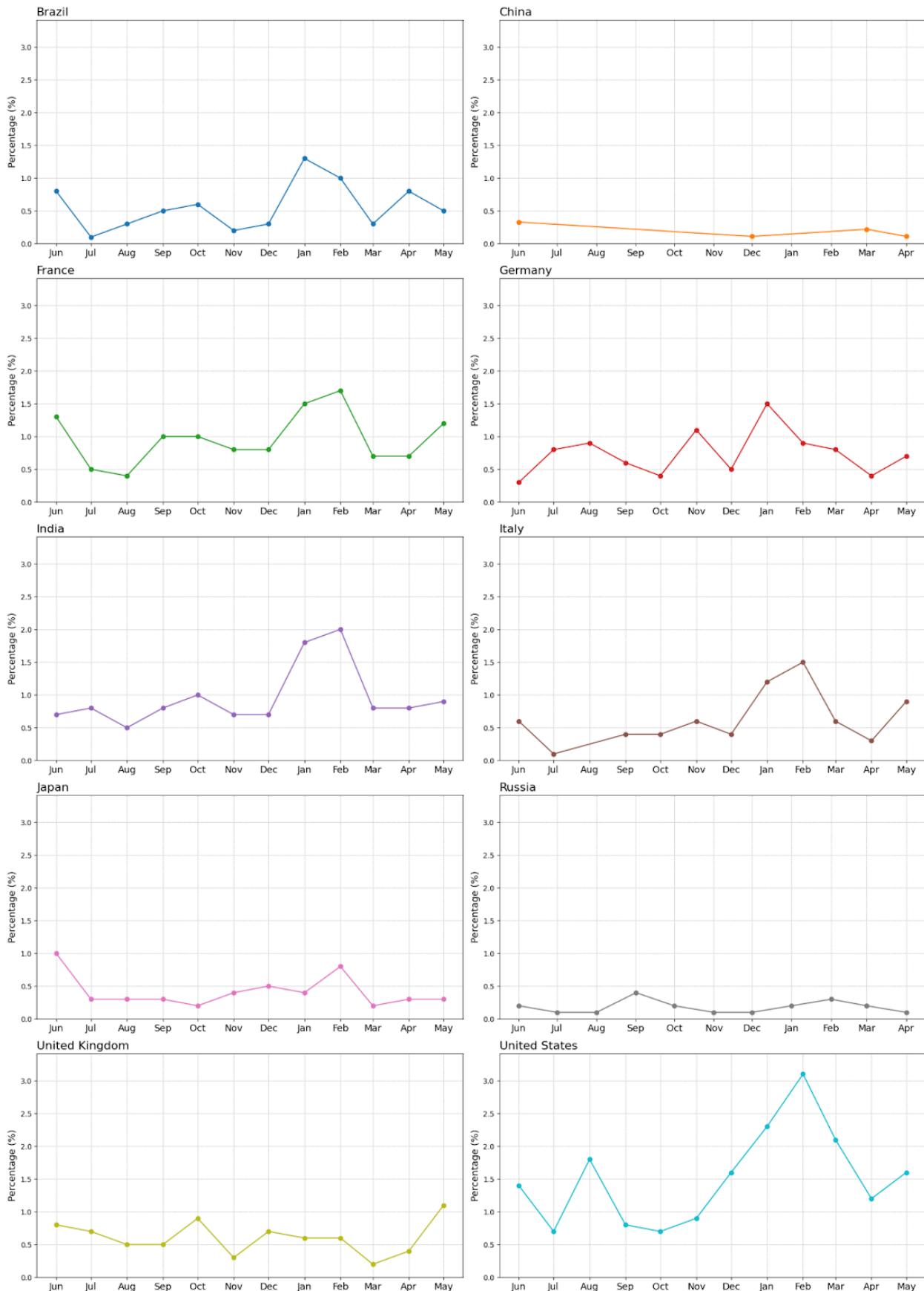


Figure 7: “AI competition and market dynamics” frame monthly frequency over time by country, represented as percentage over the total.

Figure 7 depicts the temporal evolution of the “AI competition and market dynamics in tech industries” frame from June 2024 to May 2025, illustrating how global media linked artificial intelligence to technological rivalry, innovation races, and corporate competition. Overall, this frame appears at modest frequencies but shows clear bursts of attention aligned with moments of increased economic or industrial activity.

The United States exhibits the most pronounced and consistent coverage, with visible peaks between December 2024 and February 2025, reaching over 3.0%, coinciding with major announcements by leading AI firms such as OpenAI, Google, and Nvidia, as well as stock market volatility surrounding generative AI investments. This trend aligns with the country’s technology-driven media discourse, which tends to emphasize competition, innovation, and market leadership. India also shows a progressive increase over time, culminating in a February 2025 peak (2.0%), possibly reflecting growing domestic interest in AI-driven startups and international partnerships in the tech sector.

France and Germany demonstrate similar cyclical patterns, with recurring peaks in late 2024 and early 2025. These fluctuations likely correspond to the European debate on AI competitiveness and industrial policy, particularly discussions around the EU AI Act and digital sovereignty. Italy follows a comparable trajectory, peaking in early 2025, suggesting periodic engagement rather than sustained focus on AI markets.

In Brazil, the frame remains relatively limited but exhibits short-lived increases in early 2025, which may reflect coverage of AI’s role in local business innovation and its positioning within global markets. Japan and the United Kingdom display steady but subdued patterns, generally below 1.0%, consistent with balanced coverage that integrates AI within broader narratives of technological progress rather than framing it as a market race.

Russia and China, on the other hand, show minimal engagement, China’s data indicating only sporadic mentions, suggesting that AI competition may be framed domestically more through state initiatives or strategic policy documents than through regular media discourse.

Taken together, Figure 7 highlights a strong Western-centric orientation in the reporting of AI market competition, with the U.S. and European countries showing the clearest attention peaks. Coverage in these contexts is event-driven, responding to technological breakthroughs, corporate rivalries, and policy interventions. By contrast, emerging economies and state-dominated media systems show far lower engagement, emphasizing the uneven global salience of AI competition narratives and the continuing dominance of U.S. and European discourse in shaping perceptions of technological leadership and market dynamics.

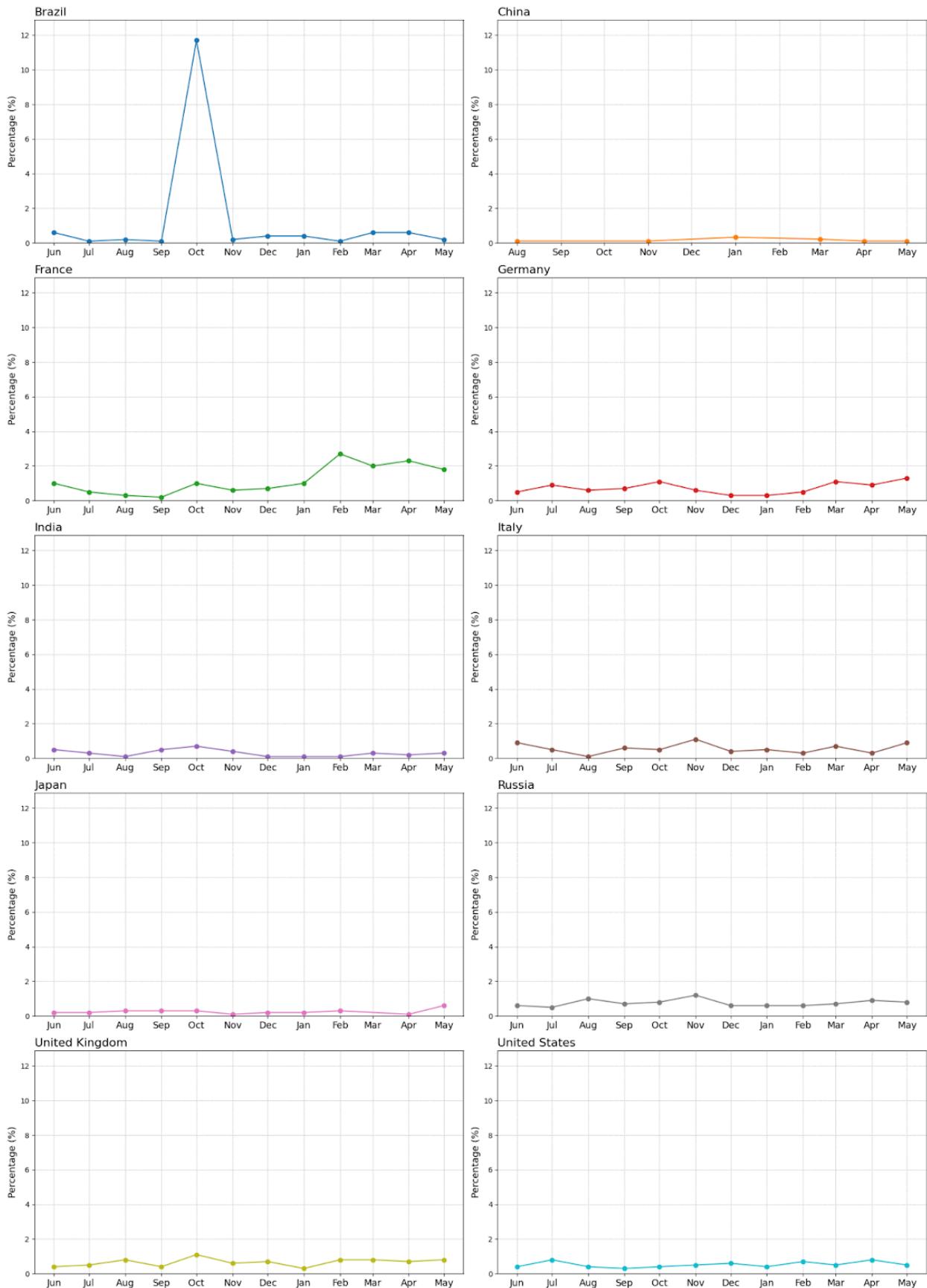


Figure 8: “AI disruptions in media and creative industries” frame monthly frequency over time by country, represented as percentage over the total.

Figure 8 illustrates the temporal distribution of the “AI disruptions in media and creative industries” frame, expressed as a percentage of frames occurrences, highlighting how different national media systems have addressed the transformative impact of AI on journalism, content production, and the broader creative economy. Overall, this frame appears intermittently across most countries, reflecting episodic bursts of attention typically tied to high-profile debates on generative AI tools, copyright disputes, and the future of creative labor.

The most striking pattern is observed in Brazil, where a dramatic spike occurs in October 2024 (11.7%), far exceeding all other months and countries. This exceptional surge likely corresponds to a major national debate or incident, after which the frequency rapidly returns to negligible levels. This spike is probably associated with the municipal elections, with AI in media as a hot topic, and the suspension of the ban on X (former Twitter) by the Supreme Federal Court.

In France, the frame shows a gradual increase over time, peaking between February and April 2025, reaching above 2.0%, suggesting sustained engagement with discussions about AI’s cultural and creative implications, particularly in light of European copyright reforms and artistic labor concerns.

Germany also shows a moderate upward trend, with attention rising through early 2025 and stabilizing around 1.0%, consistent with its emphasis on technological regulation and cultural industries. Italy follows a similar though slightly more variable trajectory, with moderate increases in late 2024 and spring 2025, reflecting growing public discourse on AI-generated art, media authenticity, and creative work ethics.

The United States and United Kingdom maintain steady, low-to-moderate levels of coverage, around 0.5–0.8%, likely tied to ongoing conversations about AI’s impact on journalism, Hollywood strikes, and intellectual property rights. Russia presents a relatively stable but higher baseline than many peers, around 0.6–1.0%, perhaps indicating an ongoing concern with digital sovereignty and media automation.

In contrast, India, Japan, and China display minimal engagement with this frame, remaining below 0.5% throughout the period, an indication that AI’s creative implications receive limited mainstream media attention in these contexts, possibly overshadowed by developmental or policy-oriented narratives.

Taken together, Figure 8 shows that media disruption is a context-dependent and event-driven frame, gaining traction primarily in Western and Latin American countries where journalism, art, and entertainment are focal points of public debate. The data reveal that while most countries sporadically acknowledge AI’s transformative potential in creative sectors, only a few, particularly Brazil, engage with it in depth, underscoring divergent national sensitivities to the cultural and ethical challenges posed by generative AI technologies.

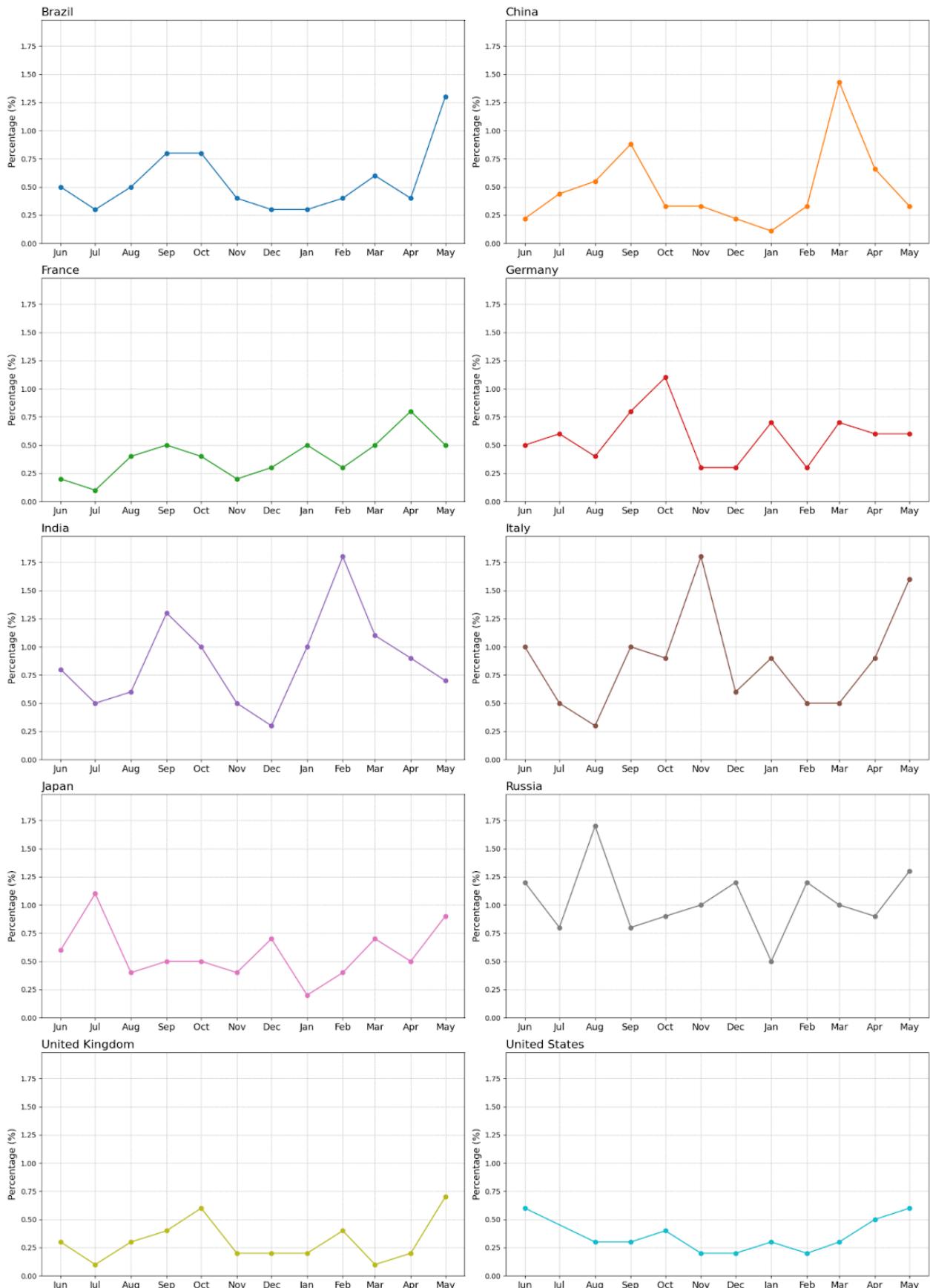


Figure 9: “AI transformations in education and research” frame monthly frequency over time by country, represented as percentage over the total.

Figure 9 displays the evolution of the “AI transformations in education and research” frame over time, measured as the percentage of total frames occurrences. This frame captures media attention on how artificial intelligence reshapes educational systems, teaching practices, and scientific research. Overall, the results show a moderate but growing engagement across most countries, suggesting that AI’s integration into education and academia is gaining sustained relevance in public discourse, though it remains a secondary topic compared to economic or regulatory frames.

In Brazil, the coverage remains consistently low until a noticeable rise in May 2025 (1.3%), potentially linked to national discussions about AI literacy or policy initiatives around digital education. China shows a similar low baseline with small oscillations, peaking at 1.4% in March 2025, which may reflect media attention to government announcements on AI-driven education or research competitiveness.

In France and Germany, frequencies remain steady and modest, below 1.0%, though both countries experience small increases in early 2025, aligning with European debates on AI’s role in higher education and academic ethics. India presents one of the most dynamic patterns, with coverage increasing notably between September 2024 and February 2025, reaching a maximum of 1.8%, which probably coincides with growing domestic investments in AI education programs and academic partnerships.

Italy exhibits similar engagement, peaking in May 2025 (1.6%), consistent with the country's discussion about AI into universities and research institutions. Russia maintains one of the highest average frequencies throughout the period, ranging roughly between 0.8% and 1.3%, suggesting continuous attention to scientific modernization and AI’s strategic role in national research.

In Japan, United Kingdom, and United States, the frame remains relatively subdued, generally below 1.0%, with mild increases in spring 2025 that likely correspond to renewed debates on AI-assisted learning tools and research productivity.

The overall pattern indicates that while AI in education and research has not yet dominated media agendas, it is progressively gaining visibility across diverse national contexts. These findings suggest that this frame represents a steadily emerging narrative, reflecting the normalization of AI as an educational and scientific resource rather than a disruptive shock, with varying national emphases tied to policy, innovation, and institutional readiness.

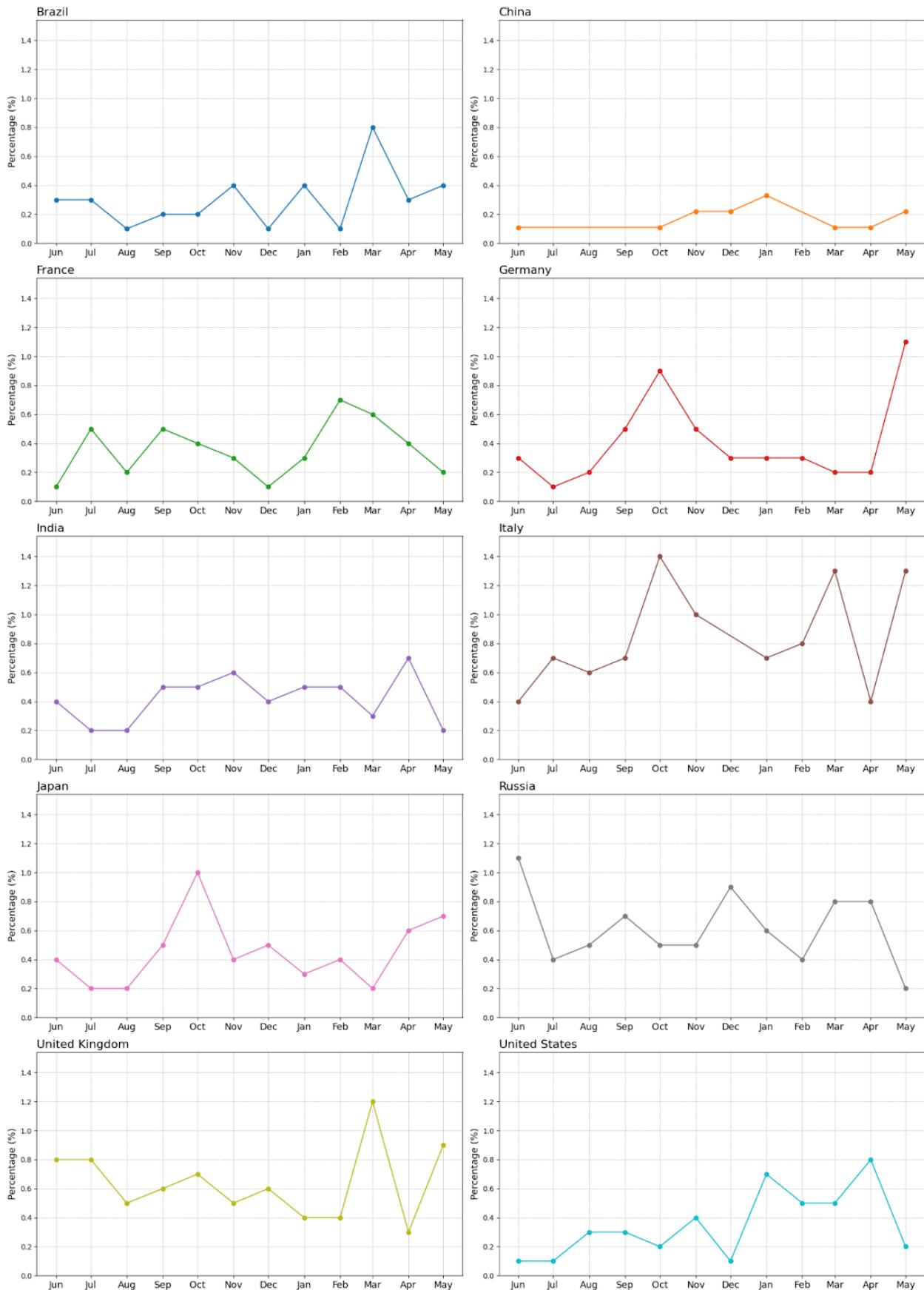


Figure 10: “AI in healthcare and climate change” frame monthly frequency over time by country, represented as percentage over the total.

Figure 10 illustrates the temporal evolution of the “AI in healthcare and climate change” frame from June 2024 to May 2025, represented as a percentage of total frames counts. This frame captures how media connect artificial intelligence to socially beneficial applications, particularly in improving health systems and addressing environmental challenges. Overall, coverage of this frame remains low but relatively stable, indicating that while health and climate-related AI innovations are present in journalistic discourse, they occupy a niche position compared to economic or regulatory narratives.

In Brazil, attention to this frame fluctuates slightly, with small peaks in March 2025 (0.8%) and May 2025 (0.4%), possibly corresponding to national discussions on AI in medical diagnostics or sustainable technologies. China maintains the lowest overall frequency, with all values below 0.4%, reflecting limited focus on these socially oriented themes.

In France and Germany, the frame appears sporadically but with some increases in early 2025, France peaks at 0.7% in February, while Germany reaches 1.1% in May 2025, suggesting episodic bursts of attention tied to health policy or climate events. India shows modest yet consistent interest, with frequencies remaining around 0.5%, indicating a balanced but limited incorporation of health and environmental AI narratives.

In contrast, Italy demonstrates the strongest engagement among European countries, peaking at 1.4% in October 2024 and 1.3% in March and May 2025, possibly driven by media discussions around AI-assisted healthcare innovations and sustainability transitions. Japan displays a similar trend, with gradual increases culminating in 0.7% in May 2025, hinting at growing journalistic focus on medical applications of AI and environmental monitoring technologies.

Russia maintains relatively high baseline values, particularly in mid-2024, where the frequency surpasses 1.0%, suggesting early and continued interest in AI’s role in national health and environmental policy. The United Kingdom also shows recurrent engagement, with a notable spike in March 2025 (1.2%), aligning with stronger policy debates on ethical AI use in public health systems. Lastly, the United States exhibits low but gradually increasing attention, peaking at 0.8% in April 2025, reflecting incremental coverage of AI-driven sustainability and healthcare innovation within a highly diversified AI discourse.

In summary, this frame reflects a cross-national pattern of moderate but meaningful engagement, where AI’s societal benefits, particularly in medicine and climate, emerge as periodic focal points rather than continuous narratives. This suggests that, while not dominant, the “AI for social good” dimension persists as a recurrent theme that gains media visibility in response to specific events or breakthroughs.

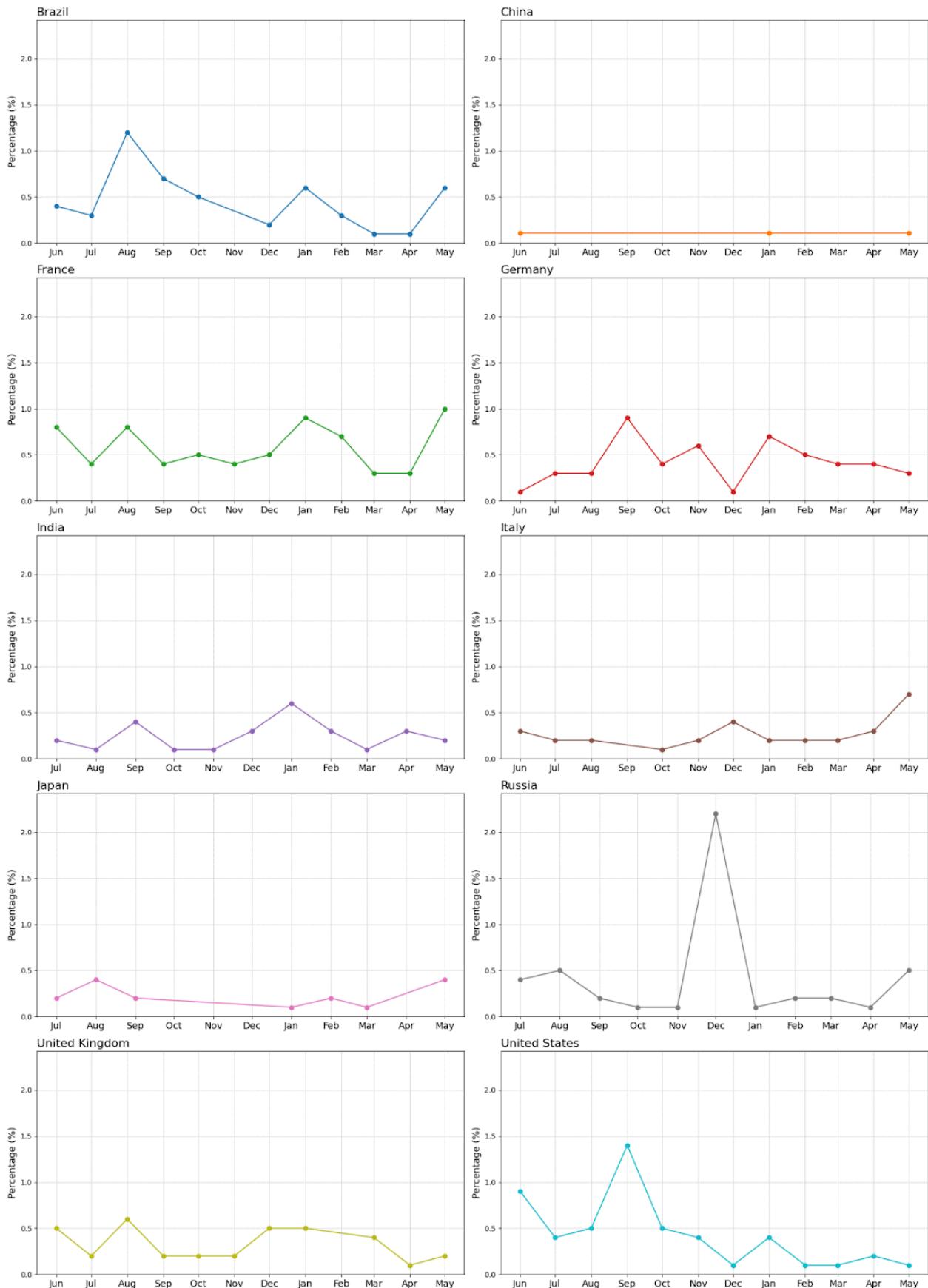


Figure 11: “AI in politics, elections, and public opinion” frame monthly frequency over time by country, represented as percentage over the total.

Figure 11 presents the monthly evolution of the “AI in politics, elections, and public opinion” frame from June 2024 to May 2025, showing the proportion of total frames counts across the ten countries. This frame captures media discussions linking artificial intelligence to electoral processes, governance, political communication, and the shaping of public opinion. Overall, the frequency of this frame remains consistently low across countries, suggesting that although the political implications of AI are acknowledged, they occupy a marginal position in the broader media discourse, often emerging reactively during periods of heightened political relevance.

In Brazil, the frame shows small fluctuations, with a modest peak in August 2024 (1.2%), possibly reflecting debates around misinformation or electoral transparency in the run-up to political events. China displays minimal variation, with extremely low frequencies (0.1%) scattered over the year.

France shows the most regular engagement with this frame among European countries, with recurrent mentions and a slight peak in May 2025 (1.0%), suggesting a gradual rise in attention to AI’s political uses and regulatory challenges. Germany also demonstrates intermittent but steady mentions, particularly around September 2024 (0.9%) and January 2025 (0.7%), potentially coinciding with European-level political developments or policy discussions. In India, coverage is minimal and stable below 1.0%, reflecting limited media emphasis on AI’s political dimensions outside of electoral cycles.

Italy shows a similar pattern, though with a small increase in May 2025 (0.7%), hinting at renewed interest in the political influence of AI, possibly linked to misinformation concerns or governance debates. Japan maintains consistently low frequencies, below 0.4%, indicating that the political framing of AI is not a dominant narrative in Japanese media. In contrast, Russia shows a notable spike in December 2024 (2.2%), far exceeding other months, likely corresponding to local political events or global discussions on AI-driven propaganda and influence operations.

The United Kingdom displays steady but subdued interest, with minor fluctuations and no sustained peaks, reflecting a low-level yet persistent concern over AI’s impact on democratic processes. Lastly, the United States records one of the highest single-month peaks among all countries, reaching 1.4% in September 2024, which may align with coverage related to electoral integrity and AI-generated misinformation in the lead-up to political campaigns.

Taken together, this frame reveals a sporadic and event-driven media engagement, where discussions of AI’s intersection with politics, elections, and opinion shaping arise episodically in response to political contexts or global controversies, rather than forming a stable narrative thread in AI coverage



Figure 12: “Other” frame monthly frequency over time by country, represented as percentage over the total.

Figure 12 illustrates the monthly frequency trends of the “Other” frame across the ten countries between June 2024 and May 2025, showing the proportion over the total number of frames. This frame groups articles that could not be confidently assigned to any of the main thematic frames, typically encompassing ambiguous, multi-topic, or marginal AI-related discussions. As expected, its overall frequency remains extremely low across all countries, rarely exceeding 0.5%, confirming both the adequacy of the main frame taxonomy and the relative thematic coherence of AI media coverage globally.

In Brazil, the “Other” frame appears sporadically, with small variations peaking modestly in March 2025 (0.4%), suggesting isolated reporting on AI issues that did not fit dominant narratives. China shows slightly more fluctuation, reaching a local maximum of 0.4% in June and September 2024, but remaining marginal throughout the period, consistent with the highly focused nature of Chinese media discourse on AI.

France, Germany, and Italy display a similar pattern, with minor, scattered mentions below 0.3%, indicating that most AI-related reporting in these countries can be categorized under established thematic frames. India follows this trend, with barely perceptible variations and consistently minimal frequencies below 0.2%. Japan and Russia also show low and irregular presence, with minor increases, such as 0.3–0.4% in Japan during September 2024 and April 2025, and in Russia during March 2025, suggesting occasional publication of AI-related news items that diverge from mainstream topics.

The United Kingdom records slightly higher values in May 2025 (0.7%), potentially linked to media coverage of niche or emerging debates that resist established framing categories. The United States exhibits a few modest fluctuations, peaking at 0.5% in April 2025, though its overall values remain low, reflecting a similarly coherent pattern of thematic classification.

Taken together, these results confirm that the “Other” category remains consistently marginal across the observed media ecosystems. Its low frequency underscores the explanatory sufficiency of the ten identified frames, while its occasional rises point to context-specific stories or emerging subthemes, perhaps reflecting new or experimental AI applications that have not yet solidified into stable media frames.

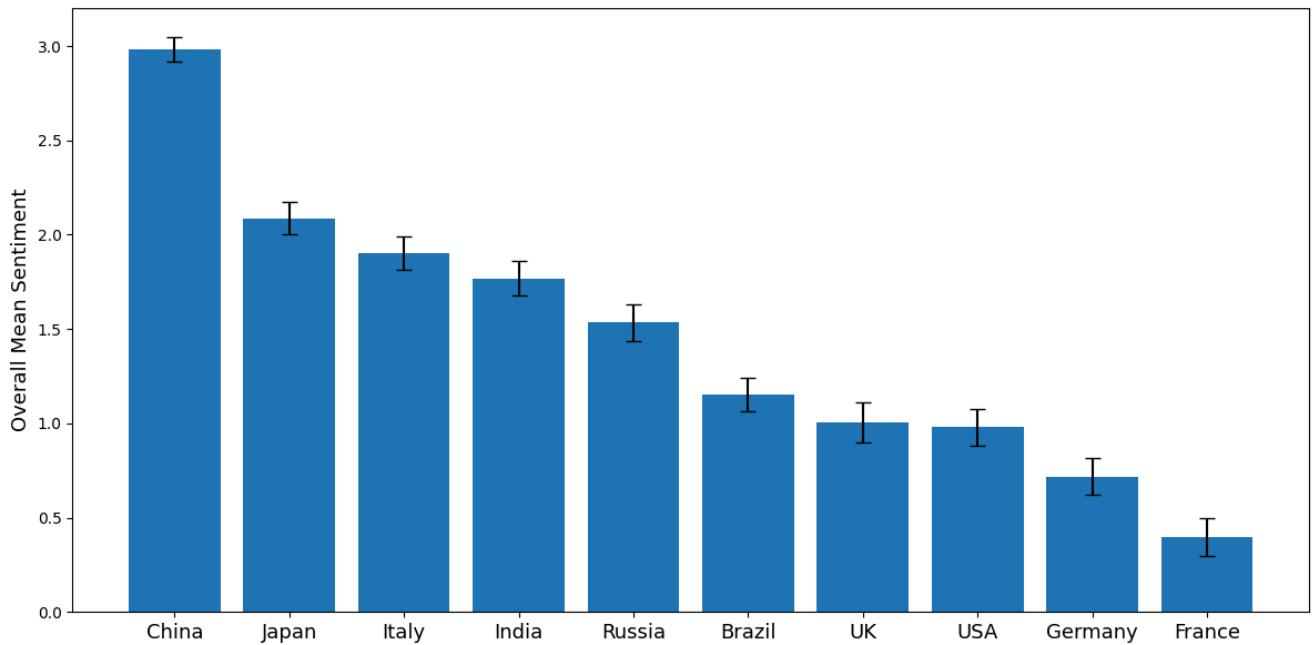


Figure 13: Mean sentiment with standard error confidence intervals for each country

The plot presents the mean sentiment of AI-related news coverage across the ten countries, accompanied by standard error of the mean (SEM) confidence intervals. Sentiment values range from -5 to +5, and are averaged across all articles, with higher values indicating a more positive tone, and lower ones reflecting more negative portrayals of AI. The inclusion of the standard error of the mean quantifies the uncertainty around each country's average sentiment, showing how much the sample mean is expected to vary if the same analysis were repeated on new samples. Narrower SEM intervals therefore indicate more stable estimates, whereas wider intervals suggest greater variability in sentiment within the country's media coverage or a smaller amount of data.

The figure reveals significant cross-country differences in tone. China stands out with the most positive average sentiment (3.0), suggesting that Chinese outlets tend to portray AI developments with optimism, likely emphasizing innovation, national progress, and technological leadership. A similar though more moderate positivity is visible in Japan (2.1), consistent with a generally constructive narrative framing AI as a driver of industrial and educational modernization. Italy (1.9) and India (1.8) follow, maintaining mildly positive tones that balance optimism with occasional concerns about social and regulatory implications.

In contrast, Russia (1.5) and Brazil (1.2) show lower sentiment scores, implying a more ambivalent or mixed discourse. The UK (1.0) and USA (1.0) display closer to neutrality sentiment, which may indicate more polarized or diversified coverage, combining enthusiasm for innovation with critical reporting on ethics, bias, and market concentration. The lowest averages emerge in Germany (0.7) and France (0.4), suggesting a comparatively skeptical or risk-oriented framing, aligned with European policy debates emphasizing regulation, transparency, and data protection. Although, it is to notice that the mean sentiment remains positive, even if by a small margin.

Overall, the cross-national variation highlights how media sentiment toward AI mirrors technological and political structures, the state-aligned optimism in China contrasts with regulatory caution in Europe and balanced ambivalence in the Anglo-American press. The inclusion of SEM-based confidence intervals reinforces the reliability of these differences by contextualizing the mean values within their sampling uncertainty, confirming that these trends are not random but reflect consistent cross-country patterns in media tone.

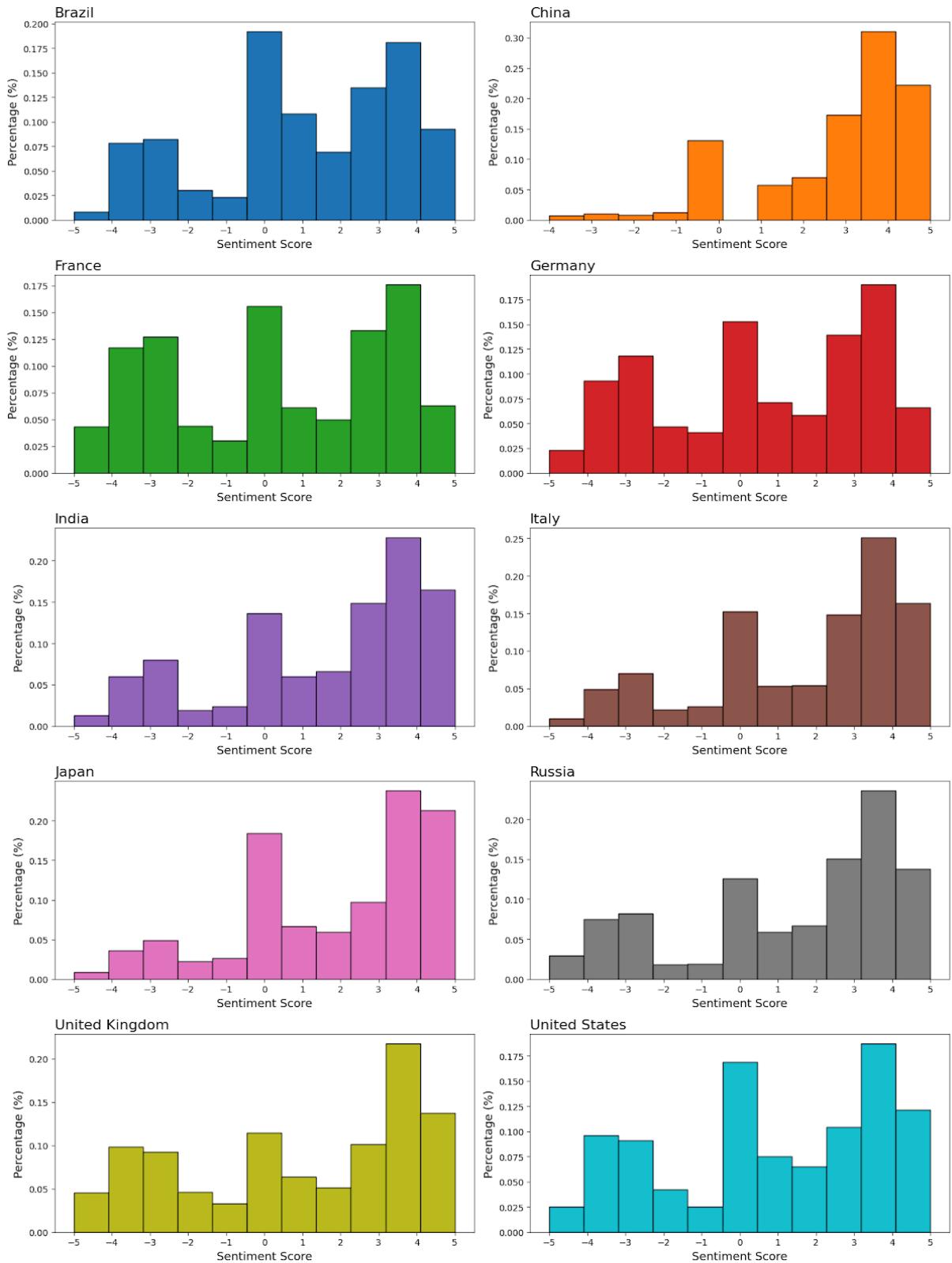


Figure 14: Sentiment distribution for each country

Figure 14 presents the sentiment distribution across countries, showing how news articles are spread along the sentiment scale ranging from strongly negative (-5) to strongly positive (+5). Overall, the distributions suggest that media coverage of AI tends to lean positive, but with meaningful cross-country variation in both skewness and dispersion.

In most countries, particularly China, Japan, Italy, and India, the distributions are clearly right-skewed, with the majority of articles concentrated in the positive range, from 3 to 5. For instance, China shows a pronounced peak at sentiment 4 and 5, with very few strongly negative values. Similarly, Japan's and Italy's distributions are dominated by high positive values, indicating overwhelmingly optimistic coverage of AI developments, likely reflecting national discourses emphasizing technological progress and innovation. India and Russia also display positive modes around 4 and 5 but include modest tails toward negative scores (-3 and -4), suggesting more balanced but still predominantly positive narratives.

In contrast, European and Western countries such as France, Germany, the United Kingdom, and the United States show more symmetric distributions, with peaks at -4, 0, and 4 values. France and Germany exhibit considerable frequencies in the positive, neutral, and negative ranges, producing a relatively balanced tone with coexisting optimism and skepticism. The U.S. and U.K. follow similar patterns, with visible peaks at positive, neutral, and negative values, pointing to heterogeneous sentiment and more polarized discourse surrounding AI, although the negative sentiment scores are less frequent.

Brazil's distribution, meanwhile, features both strong positive and strong negative peaks, but also a very frequent neutral sentiment score suggesting a fragmented public debate with alternating enthusiasm, concern, and neutral reports.

Overall, these distributions reveal two broad clusters of national coverage, one group (China, Japan, India, Italy) where positive sentiment dominates, and another (France, Germany, the U.K., U.S., Brazil) where sentiment is more evenly distributed or polarized. This pattern aligns with prior research showing that Global North media tend to balance optimism with ethical or regulatory concerns, while Global South and East Asian outlets often stress innovation and progress (Ittefaq et al., 2025; Wang et al., 2023). The diversity of shapes across countries highlights how cultural, political, and economic contexts shape sentiment associated with AI, influencing whether it is portrayed as a source of opportunity or risk.

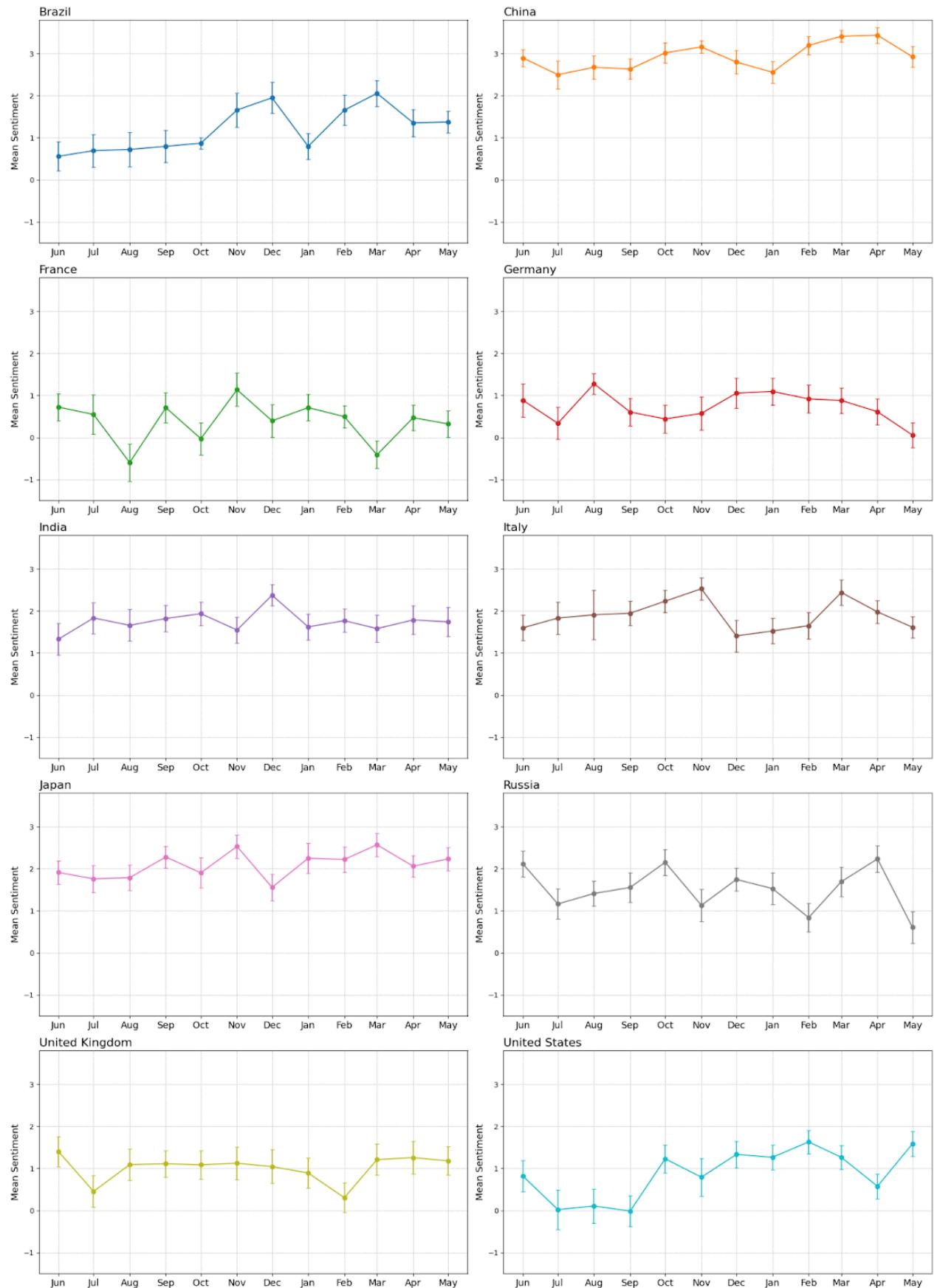


Figure 15: Monthly mean sentiment with standard error confidenceintervals over time by country

Figure 15 tracks the evolution of mean sentiment about AI coverage over time, with standard error of the mean (SEM) intervals showing the uncertainty around monthly averages.

Across the year, China consistently exhibits the highest sentiment values, between 2.5 and 3.4, suggesting persistently positive media portrayals of AI. Its sentiment trend remains stable, with only moderate fluctuations and relatively small SEM confidence intervals, implying both positivity and coherence in the coverage, but also a large amount of articles for this frame. Japan and Italy also show generally positive sentiment trajectories, particularly from late 2024 to early 2025, with Japan peaking in March 2025 (2.6) and Italy showing notable increases in November 2024 (2.6). These trends point to phases of particularly optimistic narratives around AI developments in those countries, possibly connected to policy announcements or innovation events.

By contrast, France, Germany, the United Kingdom, and the United States maintain more neutral to mildly positive mean sentiment, often close to zero or one. Their larger SEM confidence intervals in certain months, especially in summer and early fall 2024, suggest heterogeneous reporting, with some articles express enthusiasm, while others convey skepticism or concern, but also a smaller amount of articles. France even reports slightly negative sentiment in August and March, indicating moments of critical or cautionary framing.

Russia, India, and Brazil occupy intermediate positions, sentiment fluctuates considerably across months, alternating between optimism and neutrality. Brazil shows a gradual rise in positivity through late 2024, peaking in early 2025 before stabilizing. India's trend becomes more positive toward late 2024, aligning with other emerging economies that portray AI as an opportunity for development. Russia, alternates between positive and neutral phases, with a notable low point in February 2025 (0.8) followed by a sharp rebound in April (2.2), perhaps reflecting shifting geopolitical or policy narratives around AI governance.

Overall, Figure 15 underscores divergent temporal patterns of sentiment across countries some like China, Japan, and Italy maintain stable optimism, while others such as France, US, and UK oscillate between moderate positivity and neutrality. The overlapping SEM intervals across most countries and months indicate that many of these month-to-month differences are not statistically significant, yet the general ranking of countries' sentiment levels remains consistent, reinforcing the presence of national framing tendencies in AI discourse.

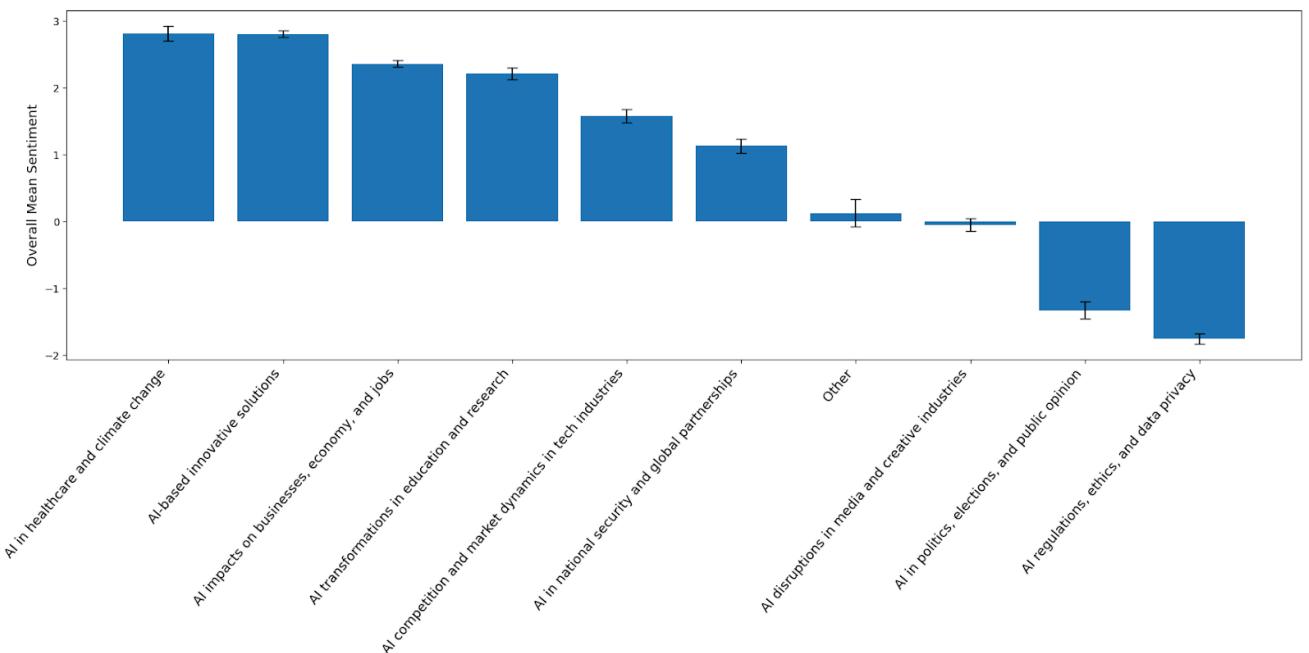


Figure 16: Mean sentiment with standard error confidence intervals for each country

Figure 16 presents the average sentiment across all countries for each frame, with standard error of the mean (SEM) confidence intervals illustrating the uncertainty around these averages. The figure provides an aggregated view of how different thematic framings of AI are portrayed in media coverage, ranging from strongly positive to negative tones.

The overall pattern shows a clear polarization of sentiment across frames, with distinct clusters of positive, neutral, and negative topics. At the positive end of the spectrum, the frames “AI in healthcare and climate change” (2.8) and “AI-based innovative solutions” (2.8) display the highest sentiment levels, indicating that AI is consistently framed as beneficial and promising when discussed in connection with health, environmental sustainability, or technological advancement. The relatively small SEM intervals suggest low variability across countries, meaning that positive portrayals of AI in these domains are widespread and stable in the media landscape, and also an elevated number of articles with these frames.

Slightly below these, “AI impacts on businesses, economy, and jobs” (2.4) and “AI transformations in education and research” (2.2) also show positive but more moderate sentiment. These frames likely combine optimistic narratives about efficiency, innovation, and learning with some cautious tones about disruption and inequality, producing lower averages.

Below in the list, “AI competition and market dynamics in the tech industry” (1.6) and “AI in national security and global partnerships” (1.1) exhibit mildly positive sentiment, suggesting that while technological and geopolitical aspects of AI generate interest and optimism, they are also associated in part with concerns over rivalry, control, and security risks.

At the neutral side, the “Other” frame (0.1) reflects weak overall sentiment and high uncertainty, consistent with the residual and heterogeneous nature of this category. “AI disruptions in media and creative industries” (~-0.1), which likely reflects concerns about job

loss, artistic displacement, and misinformation, is balanced by sporadic optimism about creative innovation, resulting in a neutral sentiment score.

Lastly, two frames show predominantly negative sentiment, “AI in politics, elections, and public opinion” (-1.3), characterized by anxiety over manipulation, polarization, and disinformation, and “AI regulations, ethics, and data privacy” (-1.8), the most negative frame, emphasizing ethical dilemmas and privacy concerns.

In summary, Figure 16 reveals that AI’s public image is strongly frame-dependent, media coverage is optimistic when AI is tied to innovation and problem-solving, but becomes skeptical or alarmed when ethical, political, or regulatory issues are presented. This polarity underscores how framing fundamentally shapes perceptions of AI’s societal role and risks.

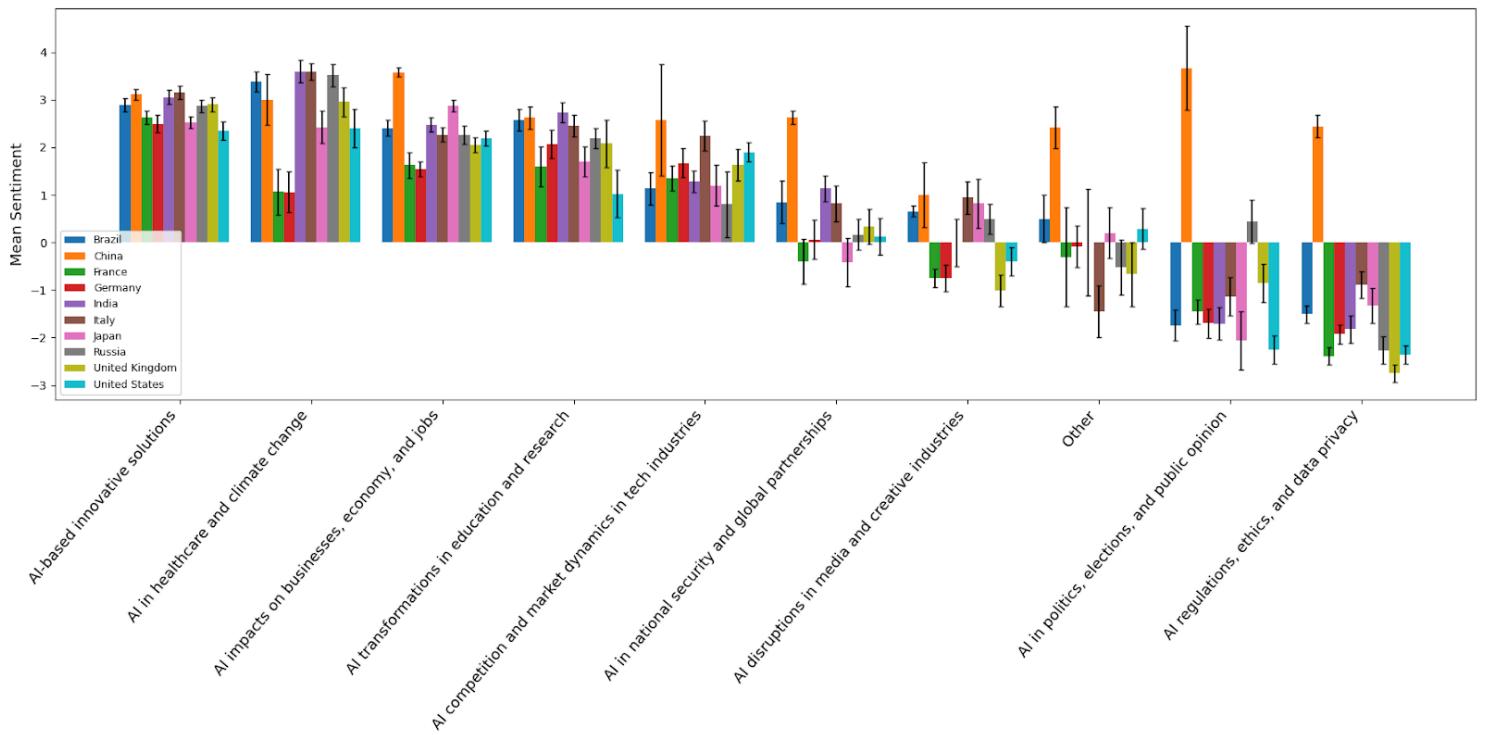


Figure 17: Mean sentiment with standard error confidence intervals for each frame by country

Figure 17 compares average sentiment scores across the ten frames for each country, including their standard error of the mean (SEM) to visualize uncertainty. This plot highlights how national media environments differ in sentiment tone when reporting about AI. Despite some shared global trends, clear cross-country differences emerge in the polarity and consistency of coverage.

Across most countries, the most positive sentiment is associated with the frames “AI-based innovative solutions” and “AI in healthcare and climate change”. These two categories consistently score around 2.5, suggesting a globally optimistic perception of AI’s problem-solving potential and societal benefits. Brazil (3.4) and Italy (3.6) show particularly strong positivity toward AI in healthcare and climate change, reflecting a techno-optimist

narrative around progress and innovation. Although France (1.1) and Germany (1.1) report less positive sentiment toward this last frame, reflecting more cautiousness.

Similarly, “AI impacts on businesses, economy, and jobs” and “AI transformations in education and research” generally maintain moderate to positive sentiment, between 1.5 and 2.5 across most countries. This indicates that, while these frames mix optimism with cautious tones about disruption and inequality, media portrayals remain largely constructive, especially in China, India, and Italy.

The middle of the distribution, frames such as “AI competition and market dynamics in tech industries” and “AI in national security and global partnerships”, exhibits greater variability. Some countries, like China, India, and Italy, report moderately positive sentiment, while others, such as France, Germany, and the U.S., lean toward neutral or slightly skeptical tones, likely due to concerns over geopolitical rivalry, surveillance, or power concentration in tech sectors.

A distinct transition to negative sentiment occurs in the lower portion of the plot. Frames such as “AI disruptions in media and creative industries” and “Other” show mixed to neutral values across countries, suggesting context-dependent or uneven coverage. For example, while China and Italy occasionally show slight optimism, other countries like France, Germany, and the U.K. are more negative, reflecting apprehension about automation’s threat to creativity and employment.

The most negative frames are “AI in politics, elections, and public opinion” and “AI regulations, ethics, and data privacy”, which register uniformly low sentiment across all countries, except China. The strongest negativity appears in the United States (-2.4) and France (-2.4), consistent with media concerns about misinformation, democratic risks, and ethical dilemmas. Even in more optimistic contexts such as India or Italy, these frames remain below zero, signaling broad global skepticism about AI’s governance and ethical implications. To notice that China reports a positive sentiment associated to each frame, this is probably linked to the low press freedom that limits the possibility of writing in a negative way about the national situation.

The SEM bars are relatively small for most positive frames, especially innovation and healthcare, indicating high cross-article consistency within countries and an elevated number of articles. In contrast, the larger errors for frames like “Other” or “AI in national security” suggest greater heterogeneity in how these topics are covered and the inferior frequency of them.

While the intensity varies by country, the general pattern underscores a global framing divide between optimistic technological narratives and critical governance discourses, reflecting how cultural, political, and economic contexts shape the emotional tone of AI-related media coverage.

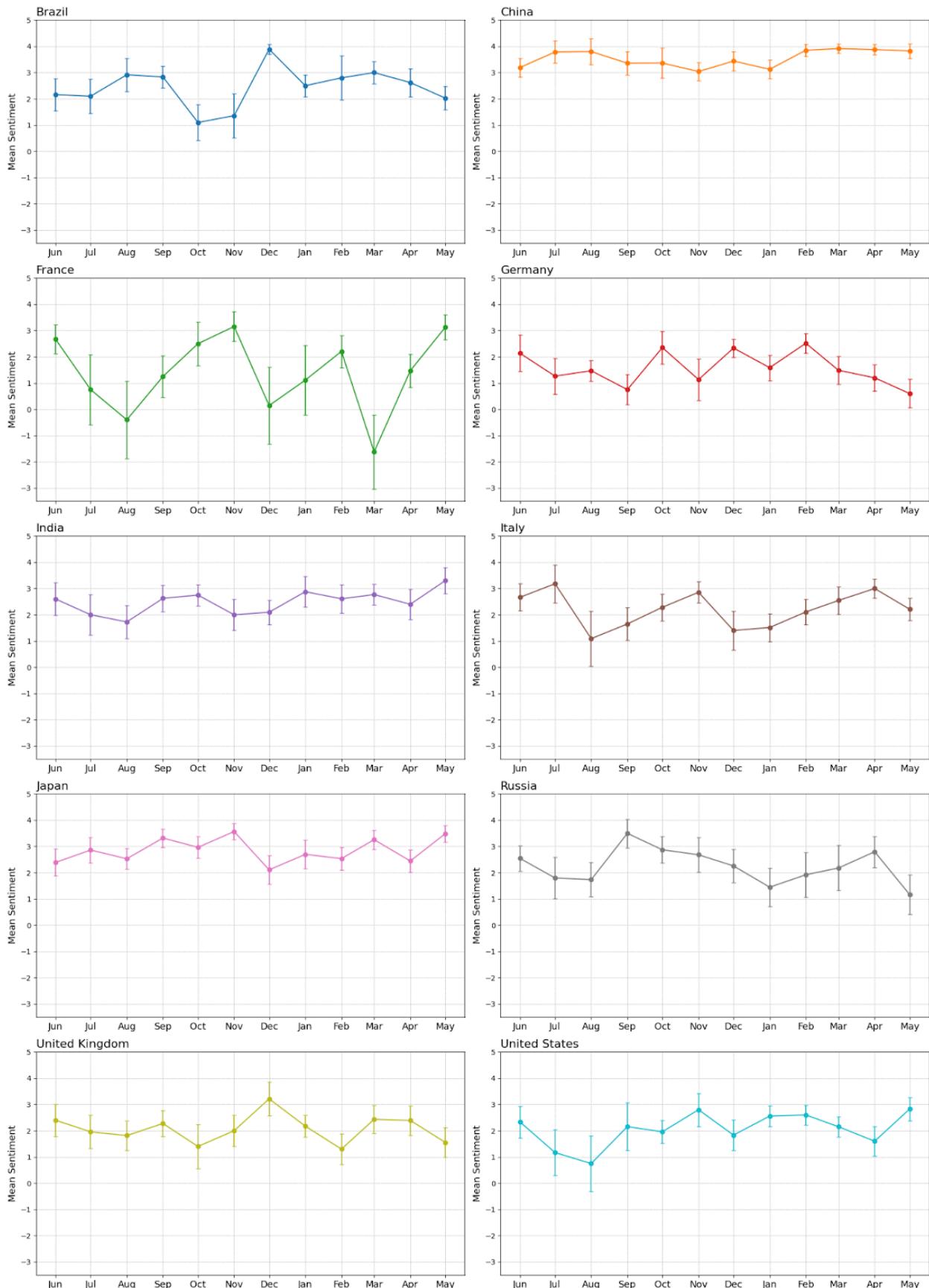


Figure 18: “AI impacts on businesses, economy, and jobs” frame monthly mean sentiment with standard error confidence intervals by country

Figure 18 illustrates the evolution of mean sentiment over time for the “AI impacts on businesses, economy, and jobs” frame across the ten analyzed countries, with standard error of the mean (SEM) intervals representing the confidence around each monthly estimate. This frame is generally associated with a positive sentiment worldwide, reflecting the optimistic tone often associated with AI’s potential to drive economic growth, innovation, and productivity, though the degree and consistency of this positivity vary considerably between countries.

China displays the most stable and consistently positive sentiment, with mean values remaining between 3.0 and 3.9 throughout the period and low SEM values, indicating homogeneous reporting or a large sample size. The consistently high positivity suggests that Chinese media predominantly frames AI as a driver of industrial progress and technological leadership, aligning with the country’s strategic economic positioning. Japan follows a similar trajectory, maintaining high and steady sentiment, mostly above 2.5, with peaks in late 2024 and May 2025 (3.5), implying strong confidence in AI’s role within its technology-driven economy.

Italy and India also show a clear positive trend, though with somewhat greater month-to-month variability. Italy’s sentiment steadily rises from mid-2024, reaching a maximum in April 2025 (3.0), reflecting growing optimism around AI’s industrial transformation potential. India exhibits stable positivity from mid-2024 onward, with a final peak in May 2025 (3.3), suggesting a narrative linking AI to emerging economic opportunities and digital modernization.

Brazil, Russia, and the United Kingdom show more fluctuation but remain generally positive. Brazil peaks sharply in December 2024 (3.9) before stabilizing around 2.5 in 2025, possibly reflecting bursts of coverage tied to AI-related economic announcements. Russia also alternates between optimism and moderation, with a notable spike in September 2024 (3.5), followed by variable sentiment, indicative of alternating narratives around economic promise and geopolitical uncertainty. The United Kingdom exhibits moderate positivity overall, with a brief surge in December 2024 (3.2), but greater uncertainty suggested by larger SEMs, implying mixed tones across sources or a lower number of articles.

France, Germany, and the United States display greater volatility and wider SEM intervals, signaling more diverse reporting or fewer articles. France shows pronounced fluctuations, from very positive values such as 3.1 in November 2024, and May 2025, to negative sentiment in August 2024 and March 2025, suggesting oscillation between optimism about AI-driven growth and concerns over job automation or inequality. Germany’s sentiment remains moderately positive but less stable, peaking in February 2025 (2.5) before declining in late spring. Similarly, the United States experiences an uneven trajectory, after subdued sentiment in mid-2024, positivity rises toward the end of the year, peaking in November (2.8) and again in May 2025 (2.8). These patterns may reflect shifting public debates over AI’s economic implications, balancing productivity benefits against risks such as labor displacement.

Overall, the figure reveals that while most countries maintain a broadly positive tone regarding AI’s economic and employment impacts, differences in temporal consistency and variability highlight contrasting national discourses. China and Japan portray AI as a stable economic enabler; Italy, India, and Brazil emphasize emerging optimism; whereas France,

Germany, and the U.S. express more nuanced, sometimes polarized perspectives. The overlapping SEM intervals across months and countries suggest that while sentiment differences are observable, many fluctuations are not statistically significant, emphasizing long-term trends over short-term variations.

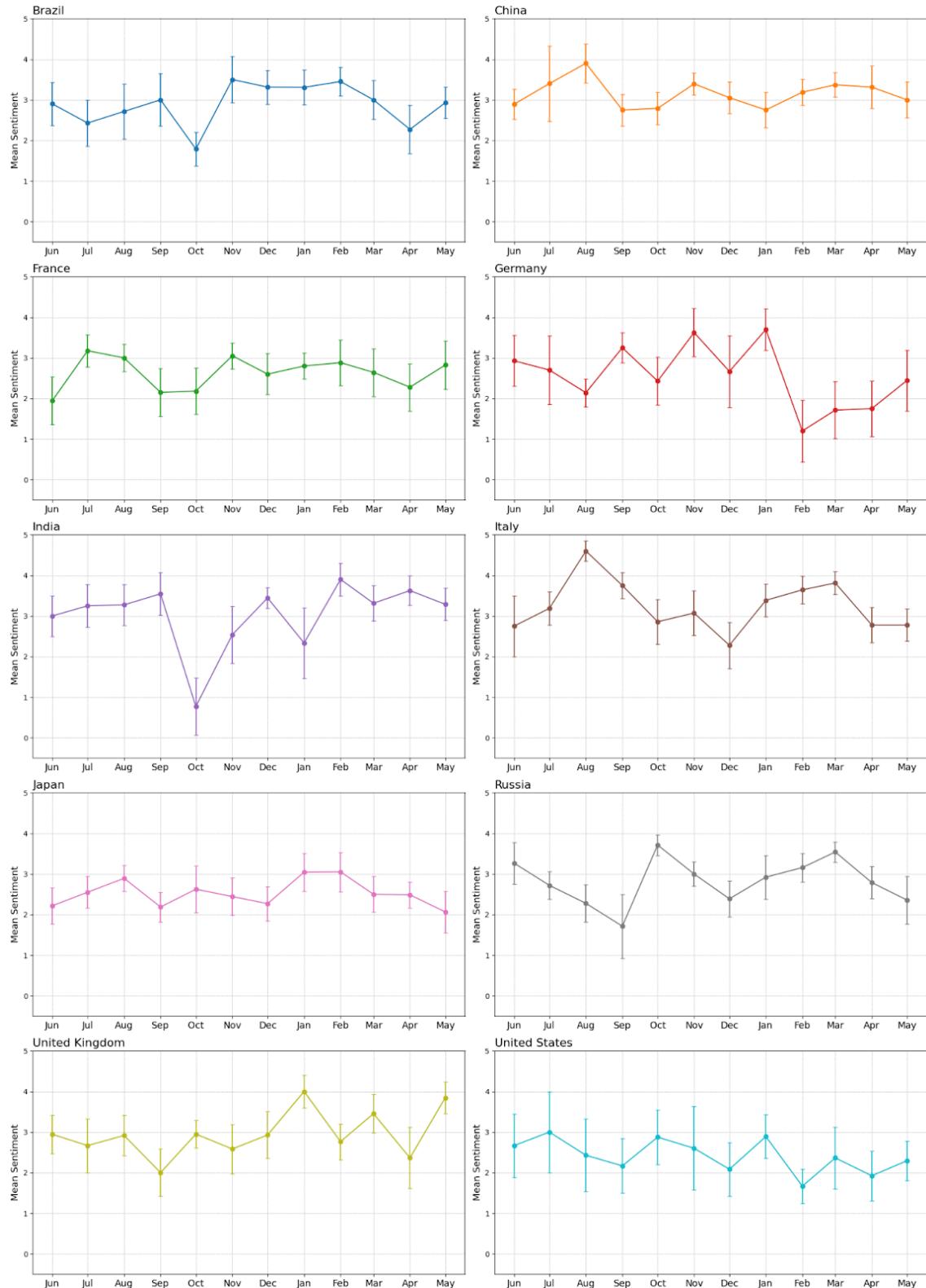


Figure 19: “AI-based innovative solutions” frame monthly mean sentiment with standard error confidence intervals by country

Figure 19 depicts the evolution of mean sentiment over time for the “AI-based innovative solutions” frame across the ten countries, accompanied by standard error of the mean (SEM) confidence intervals. This frame generally exhibits strongly positive sentiment across all countries, reflecting how media worldwide tends to emphasize the optimistic, future-oriented, and problem-solving aspects of AI innovation, particularly in relation to technological breakthroughs, startups, and research applications. However, patterns of stability, amplitude, and volatility vary considerably between national contexts.

China, India, and Italy display the most consistently positive and stable trajectories, with mean values typically between 3.0 and 3.9 and relatively small SEM intervals, indicating low within-month variability and a large amount of articles. China maintains a steady optimism throughout the period, suggesting that Chinese media systematically frames AI innovations as progress drivers in alignment with the national innovation agenda. Similarly, India records persistently high sentiment, except for October 2024, reinforcing the narrative of AI as an enabler of social and economic development in a rapidly digitizing economy. Italy’s sentiment trajectory shows pronounced positivity, peaking in August 2024 (4.6) and remaining high through spring 2025, possibly reflecting enthusiasm around applied AI in design, manufacturing, and public innovation projects.

Brazil, Japan, and the United Kingdom follow similar positive patterns but with more visible short-term variation. Brazil sustains high positivity through most of the period, reaching its maximum in late 2024 and early 2025 (3.3–3.5), suggesting growing confidence in domestic and international AI initiatives. Japan’s sentiment fluctuates moderately between 2.0 and 3.0 but stabilizes toward early 2025, hinting at steady but cautious optimism in its innovation coverage. The United Kingdom shows higher month-to-month swings, yet maintains a positive tone, with notably high means in January (4.0) and May 2025 (3.9), potentially associated with reporting on commercial and policy successes in AI adoption.

France, Germany, Russia, and the United States also show predominantly positive sentiment, though their trajectories are more heterogeneous. France’s sentiment varies between 2.0 and 3.1, with an early spike in July–August 2024 (3.0) and some decline toward the start of 2025, reflecting a balance between optimism and critical reflection on innovation outcomes. Germany’s trend, while overall positive, is marked by pronounced oscillations with high points in November 2024 (3.6) and January 2025 (3.7) followed by dips in early 2025, suggesting a more diverse tone across outlets. Russia remains mostly positive as well, with sentiment peaking in October 2024 (3.7) and March 2025 (3.5), then tapering slightly a pattern possibly tied to alternating domestic and international AI coverage. The United States shows wide SEM intervals and moderate positivity, between 2.0 and 3.0, with fluctuations suggesting a more fragmented discourse, alternating between enthusiasm for innovation and skepticism toward commercial AI narratives, but also a reduced number of articles.

Overall, Figure 19 indicates that the “AI-based innovative solutions” frame is the most uniformly positive across countries among all analyzed frames, with mean sentiment consistently above 0 and limited evidence of strong negativity. Cross-country variability lies primarily in the amplitude of fluctuations rather than in direction, Asian and Southern European outlets display steady optimism, while Western European and North American

media show greater variability and uncertainty. Some SEM intervals overlap, meaning that differences between countries and months may not be statistically significant. The general trend highlights a globally shared discourse of technological optimism, where AI innovation is framed as a leading force of progress and opportunity rather than as a source of risk.

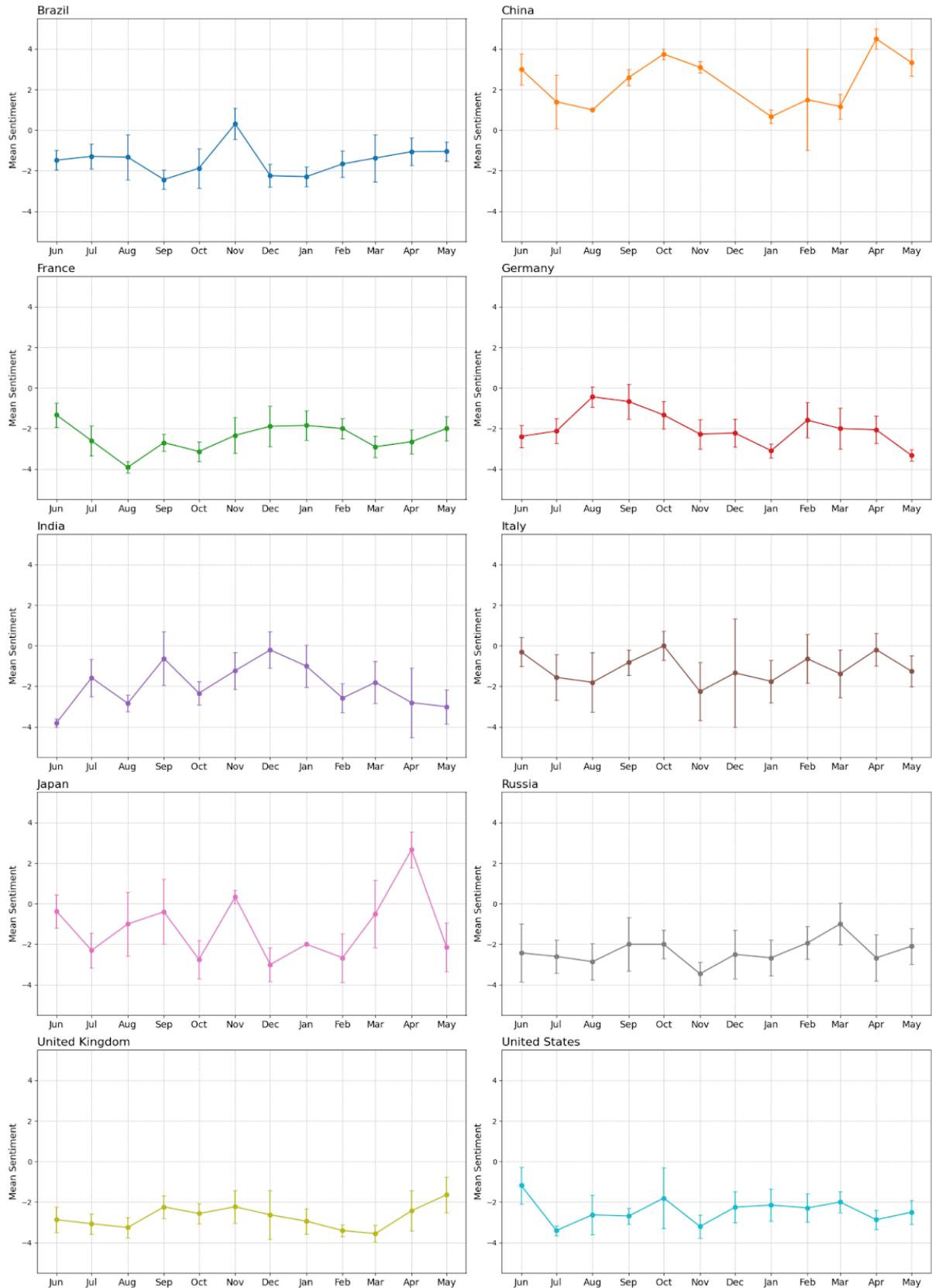


Figure 20: “AI regulations, ethics, and data privacy” frame monthly mean sentiment with standard error confidence intervals by country

Figure 20 presents the evolution of mean sentiment over time for the “AI regulations, ethics, and data privacy” frame across countries, with standard error of the mean (SEM) intervals reflecting the uncertainty of monthly sentiment estimates. In contrast to most other frames, this one is characterized by predominantly negative sentiment, underscoring the critical tone and concerns surrounding ethical implications, regulatory uncertainty, and data protection challenges in the global discourse on AI. Across the observed period, most countries show mean sentiment values well below zero, suggesting that coverage of AI governance issues tends to focus on risks, controversies, and accountability gaps, rather than on opportunities or progress.

European countries, especially France, Germany, and the United Kingdom, display the most consistently negative sentiment patterns. France maintains highly negative values throughout, with a minimum around August–October 2024 (−3.9), reflecting intense debate about AI risks, algorithmic bias, and European regulatory actions such as the AI Act. Similarly, Germany’s sentiment fluctuates around −2.0 to −3.0 for much of the period, peaking in negativity in May 2025 (−3.3), suggesting persistent caution and public skepticism about data privacy and compliance. The United Kingdom mirrors this trend, with remarkably stable and strongly negative sentiment between −2.5 and −3.5, particularly during late 2024 and early 2025, a period marked by national discussions about AI oversight and governance frameworks following international AI summits.

The United States also shows a mostly negative tone, with mean values between −2.0 and −3.0, reflecting ongoing debates over data security, corporate responsibility, and the tension between innovation and regulation. Despite some month-to-month fluctuations, U.S. sentiment remains clearly below neutral, indicating widespread caution in media framing of ethical AI topics.

In contrast, China stands out as the only country with a predominantly positive sentiment trajectory. Monthly means range mostly between 2.0 and 4.0 from mid-2024 to spring 2025, with a marked peak in April 2025 (4.5). This suggests that Chinese media tends to portray AI regulation and ethics as constructive and progress-oriented, often emphasizing the effectiveness of governance initiatives and the country’s leadership role in setting global standards. However, large SEM values in some months, such as July 2024 and February 2025, suggest limited data or heterogeneous reporting within the sample.

Elsewhere, Brazil, India, Italy, Japan, and Russia exhibit more mixed or moderately negative sentiment. Brazil’s coverage is consistently negative until late 2024, with mean values around −1.5 to −2.5, before a slight moderation in early 2025 (−1.0). India’s trajectory oscillates between −3.8 and −0.2, indicating variability between strongly critical and more neutral reporting phases. Italy shows a similar fluctuation pattern with wide SEM intervals, suggesting diverse opinions and smaller sample sizes, while Japan displays alternating negativity and brief positive spikes, perhaps reflecting periodic optimism about policy alignment or ethical guidelines. Russia maintains a persistently negative tone, between −2.0 and −3.5, highlighting skepticism toward regulatory debates and domestic challenges in data governance.

Overall, the figure demonstrates that the “AI regulations, ethics, and data privacy” frame is consistently associated with the lowest sentiment across all topics analyzed, indicating a widespread perception of ethical and regulatory challenges as sources of tension rather than opportunity. The notable exception of China reflects divergent national narratives. While most countries’ media highlight risks and controversies, Chinese coverage tends to emphasize control, order, and institutional capability. The overlapping SEM intervals across months and countries suggest that some differences may not be statistically significant, yet the overall polarity distinction, especially between China’s positivity and Europe’s negativity, clearly illustrates the geopolitical polarization in global AI ethics discourse, and also the differences in press freedom between China and the other countries.

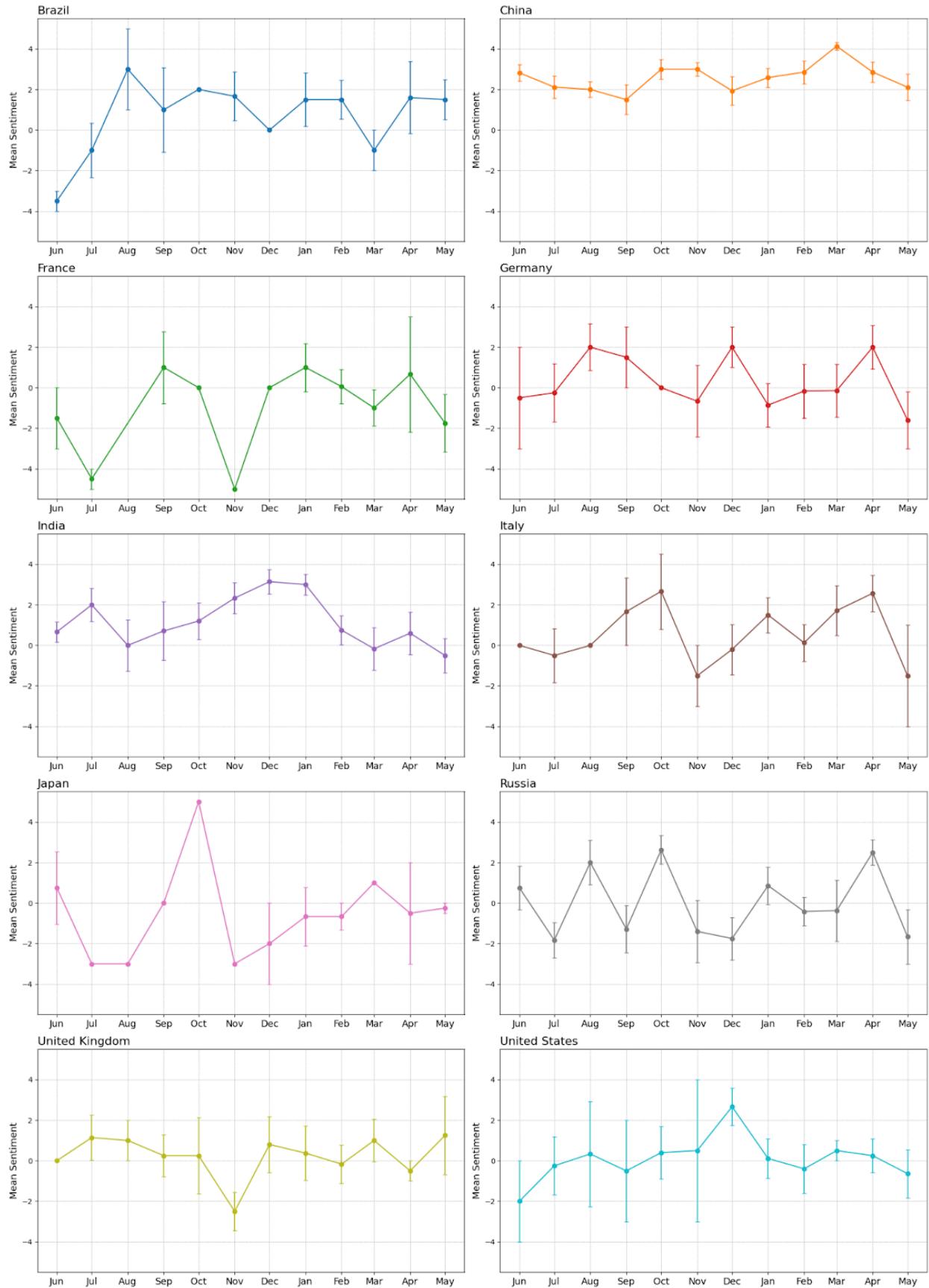


Figure 21: “AI in national security and global partnerships” frame monthly mean sentiment with standard error confidence intervals by country

Figure 21 illustrates the evolution of mean sentiment over time for the “AI in national security and global partnerships” frame across countries, with standard error of the mean (SEM) confidence intervals capturing the uncertainty of monthly averages. This frame, covering topics such as AI-driven defense innovation, cybersecurity, and international cooperation or rivalry, shows high volatility and wide confidence intervals across nearly all countries, reflecting both the sporadic coverage of these issues and their context-dependent emotional tone. Because national security reporting often responds to specific geopolitical events or diplomatic developments, the sentiment patterns tend to fluctuate sharply rather than following consistent trends.

China stands out as the only country with consistently positive sentiment across the period. Monthly means remain above 2.0, peaking in March 2025 (4.1), suggesting that Chinese media largely portray AI in defense and global cooperation as a strategic strength and symbol of national progress. The low SEM intervals for many months indicate relatively stable narratives emphasizing technological leadership and constructive partnerships rather than confrontation, and also a large coverage of this frame.

By contrast, Western countries such as France, Germany, the United Kingdom, and the United States show high variability and frequent sentiment reversals, suggesting more ambivalent or contentious reporting. France exhibits the most dramatic swings, from deeply negative values, such as -4.5 in July 2024 and -5.0 in November 2024, to moderate positivity in early 2025. These sharp oscillations likely reflect alternating narratives about security risks, ethical concerns over military AI use, and sporadic optimism about international cooperation. Germany shows a similar pattern of fluctuation around neutrality, ranging between -2.0 and 2.0, with wide SEM intervals, indicating a small and diverse sample of coverage. The United Kingdom and the United States also hover near neutral overall but display considerable month-to-month dispersion, brief optimism appears in late 2024 and early 2025, like December 2024 for the U.S. at 2.7, followed by declines, consistent with reactive reporting linked to specific security summits, AI arms race debates, or alliance agreements.

In Brazil, the sentiment trajectory begins negatively in mid-2024 but quickly turns positive from late 2024 onward, stabilizing around mild optimism. This suggests a shift from initial concern over global power imbalances to a more favorable view of Brazil’s participation in international technology dialogues. However, very large SEM intervals point to high uncertainty and limited coverage. India’s coverage trends more positively, especially between November 2024 and January 2025 (2.3–3.1), possibly linked to domestic narratives about AI’s potential and the country’s emerging role in global AI governance frameworks.

Italy, Japan, and Russia show particularly erratic sentiment patterns, alternating between sharp negativity and high positivity. Italy’s sentiment spans from -1.5 to 2.6, with large standard errors reflecting diverse perspectives in limited coverage. Japan displays extreme outliers, for example, 5.0 in October 2024 and -3.0 in several earlier months, likely due to isolated articles with contrasting tones on defense ethics or alliances. Russia oscillates between modestly negative and mildly positive sentiment, around -2.0 to 2.5, perhaps mirroring mixed domestic narratives about AI militarization, sovereignty, and international engagement.

Overall, this figure reveals that the “AI in national security and global partnerships” frame is among the most unstable and polarized across countries. While most nations’ sentiment averages hover around neutral, the large SEM intervals highlight the fragmented and event-driven nature of this discourse, shaped by specific geopolitical developments rather than consistent thematic framing. China remains an exception, with sustained positivity and relatively low uncertainty, underscoring the country’s cohesive and self-affirming portrayal of AI’s strategic role, in contrast to the cautious, fluctuating tone prevalent in Western and other global media.

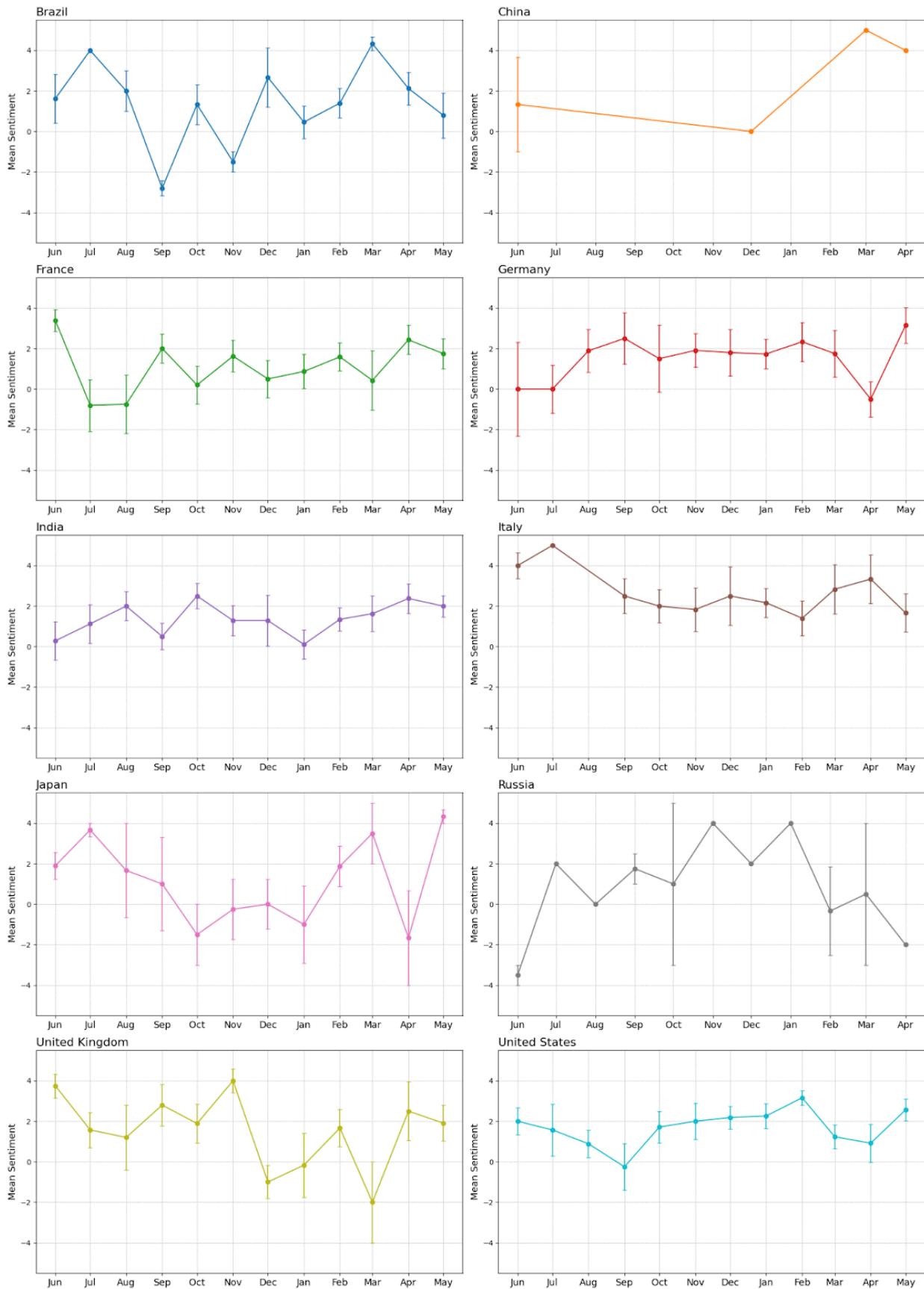


Figure 22: “AI competition and market dynamics in tech industries” frame monthly mean sentiment with standard error confidence intervals by country

Figure 22 displays the monthly evolution of mean sentiment for the “AI competition and market dynamics in tech industries” frame, with standard error of the mean (SEM) intervals showing the degree of uncertainty around each monthly average. This frame focuses on narratives about corporate rivalry, market power, and the global race for AI leadership, themes that often evoke both enthusiasm for innovation and concern about monopolization or inequality in technological development.

Across countries, sentiment is predominantly positive, indicating that coverage of AI competition and market trends is generally framed in terms of technological optimism and economic opportunity rather than threats or risks. However, substantial month-to-month fluctuations and wide SEM intervals suggest that sentiment is highly reactive to market news, policy announcements, or corporate events.

Brazil exhibits large variability, alternating between positive peaks, like 4.3 in March 2025, and negative troughs, for example –2.8 in September 2024. Early 2024 coverage is mostly positive, possibly tied to narratives about AI-driven growth and Brazil’s participation in global innovation ecosystems. The sharp negative shift in September could reflect domestic concerns about competitiveness or foreign tech dominance. After this dip, sentiment stabilizes in a moderately positive range, though SEM intervals around 1.0 indicate persistent heterogeneity and lack of data.

China presents an overwhelmingly positive and stable sentiment, with means near 4.0 to 5.0 and virtually no negative months. This is due to the extremely low number of articles with this frame that are published in China in the last year.

France, Germany, India, Italy, and the United States all show predominantly positive sentiment but with notable variation in intensity. France starts with a highly positive tone in June 2024 (3.9), dips briefly into neutrality or mild negativity in mid-2024, and returns to optimism in early 2025. Germany follows a similar pattern, with sentiment hovering between 1.5 and 3.0 for most months, pointing to stable yet cautious optimism about AI market dynamics in Europe. India’s trajectory mirrors this optimism, sentiment remains positive throughout the period, peaking in October 2024 (2.5), likely tied to coverage of India’s expanding AI sector and startup ecosystem.

Italy shows a distinctly positive and consistent pattern, with multiple months above 2.0 and occasional peaks at 4.0 and 5.0. This may reflect national pride in technological advancement or optimism about EU-level industrial policies in AI. SEM values around 1.0 indicate moderate variation, typical for smaller sample sizes but consistent overall framing.

Japan’s sentiment oscillates between positive and negative extremes, reflecting polarized narratives, with strong enthusiasm for AI innovation and competition, such as 3.5 in March and 4.3 in May 2025, alternating with sharp dips, like –1.5 in October 2024 and –1.67 in April 2025. This bimodal pattern may reflect tensions between excitement about technological progress and concern over market saturation or ethical implications of aggressive AI competition.

Russia, the United Kingdom, and the United States display broadly positive sentiment as well, though with episodic downturns. Russia’s trend is especially erratic, ranging from deeply negative, like –3.5 in June 2024, to very positive, such as 4.0 in January 2025, suggesting a fragmented media landscape or sensitivity to external events such as sanctions,

partnerships, or AI regulation debates. The United Kingdom shows generally high sentiment, with brief dips in December 2024 and March 2025, reflecting a mix of celebratory business coverage and critical perspectives on market concentration. The United States exhibits a steady upward trajectory, starting near neutrality mid-2024 and peaking at 3.2 in February 2025, a pattern consistent with optimism surrounding AI investment and competition among major tech firms.

Overall, this frame stands out as more positively charged across countries when compared with the more cautious or negative tones found in the “AI regulations, ethics, and data privacy” or “AI in national security” frames. However, the wide SEM intervals across several countries reveal the diversity of perspectives and temporal variability tied to specific market developments, but also a low number of articles. Notably, China and Italy display the most stable and consistently positive sentiment, suggesting unified discourses emphasizing innovation and leadership, while Japan, Brazil, and Russia exhibit greater volatility, reflecting domestic debates over competitiveness and the broader implications of global AI market dynamics.

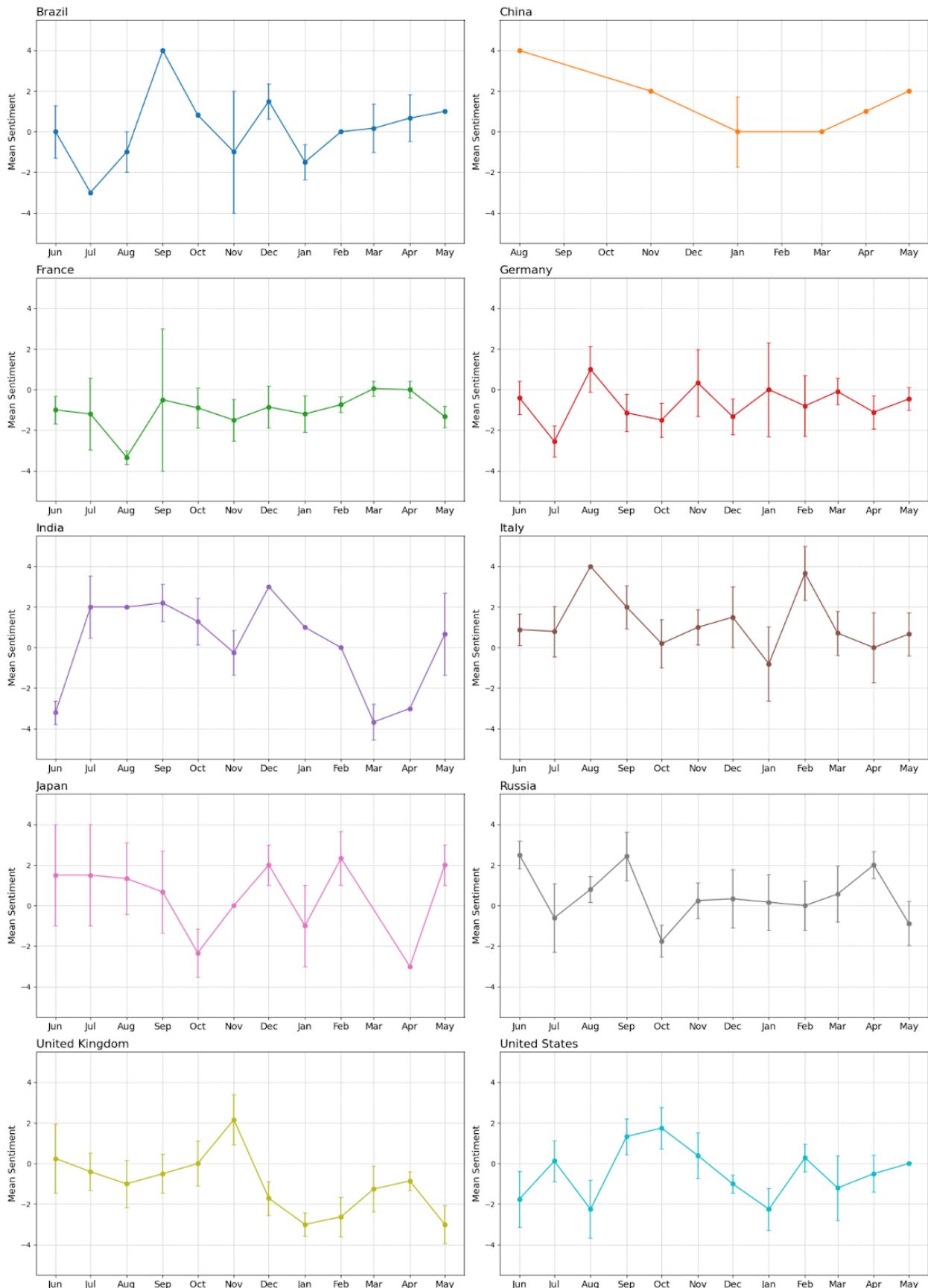


Figure 23: “AI disruptions in media and creative industries” frame monthly mean sentiment with standard error confidence intervals by country

Figure 23 presents the monthly mean sentiment and associated standard error of the mean (SEM) for the “AI disruptions in media and creative industries” frame, across the ten countries. This frame captures media narratives about AI’s impact on journalism, content creation, art, and entertainment, areas where automation intersects directly with human creativity, professional identity, and cultural production.

Across all countries, the figure reveals high volatility and wide confidence intervals, reflecting the polarized and uncertain tone surrounding AI’s role in creative domains. Sentiment oscillates between optimism about innovation and deep concern over job displacement, authenticity, and copyright issues.

Brazil displays one of the most erratic trajectories, alternating between extreme values, from –3.0 in July 2024 to 4.0 in September. Such oscillations likely correspond to alternating narratives, negative sentiment in mid-2024 could relate to fears about AI replacing creative jobs or misinformation concerns, while the brief positive spike may coincide with celebratory reporting on AI-driven artistic innovation. These oscillations, also, depend on the limited number of articles for this frame.

China shows a mostly positive but fragmented pattern, with values clustering around 2.0 to 4.0 and several months missing or neutral. Despite limited data points, the tone suggests that AI in creative industries is largely viewed as an opportunity for modernization and global competitiveness, consistent with China’s broader framing of AI as an enabler of national innovation.

France and Germany exhibit predominantly negative to neutral sentiment, especially in mid-2024, with mean sentiment scores around –1.0 to –2.0. This reflects European media’s more critical discourse on AI’s cultural and ethical consequences, echoing public debates about copyright protection, artistic originality, and the rights of creative workers. France’s sentiment becomes slightly more neutral or positive in early 2025, hinting at a gradual normalization of AI tools in creative work.

India’s sentiment is highly bimodal, alternating between sharp enthusiasm and deep skepticism. The early negative value, with –3.2 in June 2024, suggests concern over disruption to creative works, while later positive peaks, such as 3.0 in December 2024, reflect excitement about AI adoption in film and design industries. The return to strong negativity in March–April 2025 indicates renewed apprehension, possibly due to local controversies or the influence of global debates on creative ownership.

Italy presents mostly positive sentiment, particularly in mid-2024, peaking at 4.0 in August. The country’s media appear to frame AI’s creative potential more optimistically, emphasizing artistic collaboration rather than replacement. However, later months show moderation toward neutrality, suggesting a recognition of emerging ethical and professional tensions.

Japan displays a mixed but overall positive tendency, though with large SEM intervals suggesting diverse opinions within the press or a lack of articles with this frame. Negative values in October 2024 (–2.3) and April 2025 (–3.0) may reflect cultural anxiety about authenticity and creative integrity, while high positive peaks in May 2025 (2.0) illustrate renewed optimism regarding AI-assisted production in media and entertainment.

Russia's trend oscillates between mild positivity and neutrality, indicating ambivalence. Positive sentiment spikes, like 2.5 in June 2024, might correspond to AI being portrayed as a technological advancement tool, while intermittent negatives, such as -1.75 in October 2024, could relate to concerns over propaganda, creative control, or economic inequality in the creative sector.

The United Kingdom shows a clear negative drift over time, with sentiment decreasing from near 0 in mid-2024 to -3.0 by early 2025. This aligns with critical debates in the UK media industry over generative AI's threats to artists' rights and journalism integrity. High SEMs indicate heterogeneous reporting, consistent with an ongoing national debate rather than a unified framing, and also a low number of articles.

The United States also reveals negative-leaning sentiment overall, fluctuating between mild positivity, like 1.8 in October 2024, and notable downturns, such as -2.3 in January 2025. The narrative here appears divided between innovation enthusiasm and strong criticism from artists, writers, and unions, especially around the 2024 Hollywood strikes and AI's role in content creation.

Overall, this frame is characterized by instability and polarization, with no country maintaining a consistent tone. The wide SEM intervals underscore the diversity of journalistic perspectives and the contested nature of AI's impact on creativity and also a not elevated number of articles. Positive sentiment spikes in China, Italy, and Japan highlight enthusiasm for technological creativity, while sustained negativity in Western countries like France, UK, and US reflects persistent ethical and professional concerns. Collectively, these trends portray the "AI disruptions in media and creative industries" frame as one of the most emotionally charged and socially divisive narratives in the international AI discourse.

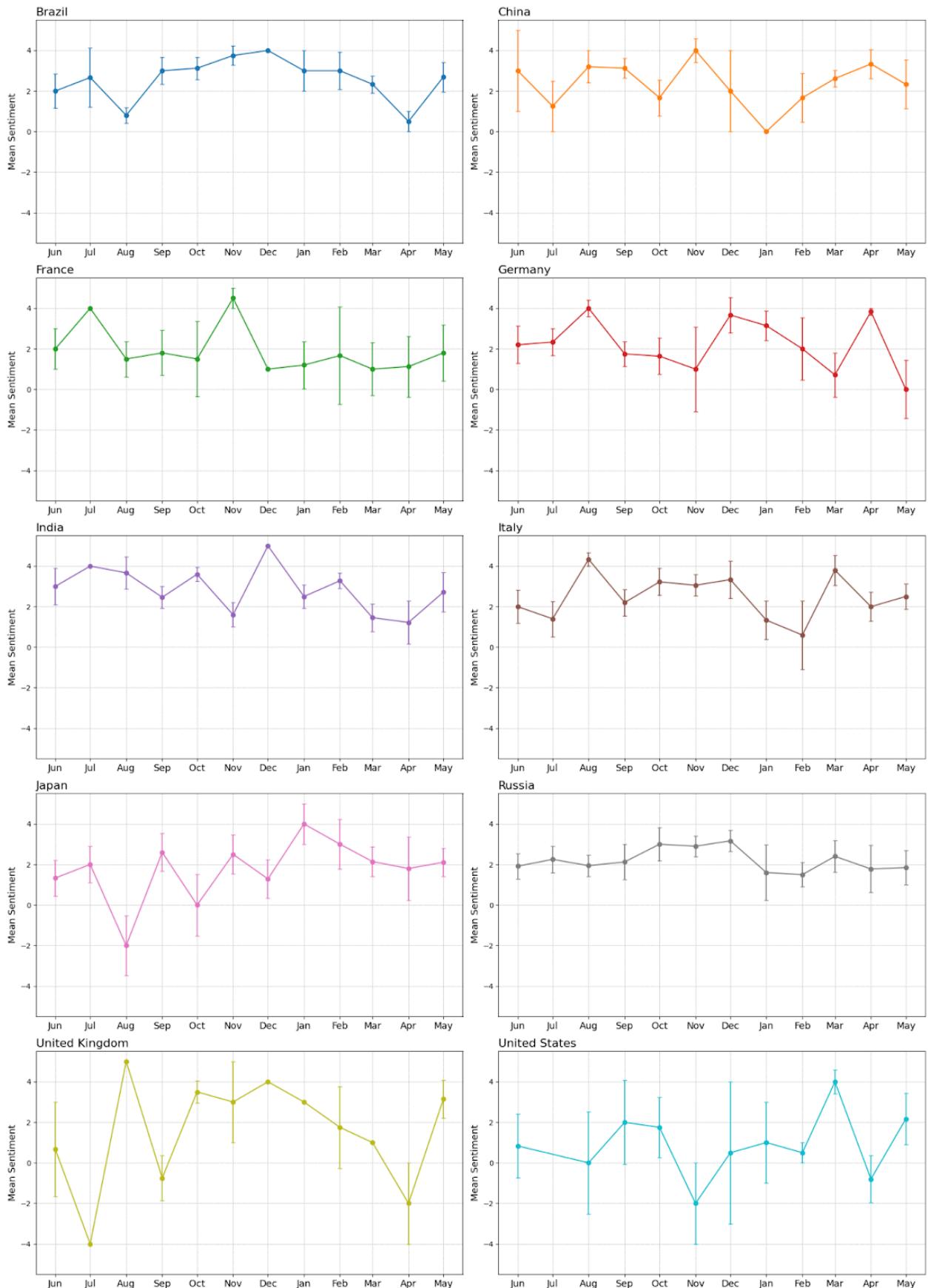


Figure 24: “AI transformations in education and research” frame monthly mean sentiment with standard error confidence intervals by country

Figure 24 depicts the monthly mean sentiment and standard error of the mean (SEM) for the “AI transformations in education and research” frame across the ten countries. This frame captures media narratives concerning the adoption of AI in learning, teaching, academic research, and scientific innovation. It is generally among the most positively framed topics in the AI discourse, reflecting optimism about technological progress while occasionally revealing ethical and practical concerns regarding accessibility, bias, and the future of human expertise.

Across countries, the overall trend is positive, with most mean sentiment values lying between 2.0 and 4.0, indicating that news coverage tends to highlight the benefits of AI-driven educational innovation more than its drawbacks. However, some countries show notable fluctuations and uncertainty, reflected in wide SEM values, suggesting diversity in the tone of reporting, while also noting a not large sample of news articles.

Brazil exhibits a consistently positive and upward trend throughout the observation period. Sentiment rises from moderately positive values in mid-2024 to peaks above 3.5 toward the end of the year, reaching 4.0 in December 2024. This strongly positive tone likely mirrors enthusiasm about the integration of AI tools in Brazilian classrooms and universities, possibly reflecting the country’s policy emphasis on educational modernization. However, a decline in April 2025 (0.5) suggests some emerging critical discourse about challenges or disparities in implementation.

China also displays a generally positive sentiment trajectory, though with larger variance. Sentiment values frequently exceed 3.0, particularly in late 2024 and early 2025, consistent with China’s broader narrative of AI as a strategic asset for national advancement in science and technology. The relatively high SEM intervals in several months indicate that the coverage for this frame is limited.

France shows moderate but fluctuating positivity, ranging from 1.0 to 4.5. The high sentiment in July 2024 (4.0) and November 2024 (4.5) contrasts with more tempered months around the turn of 2025, implying episodic bursts of enthusiasm, perhaps corresponding to policy announcements or major educational initiatives. The wide SEM intervals indicate that French media engage with both optimistic and critical framings, but also a limited amount of articles.

Germany presents a balanced yet positive pattern, with sentiment peaking at 4.0 in August 2024 and again in April 2025 (3.8). The stability of moderate-to-high positivity suggests a pragmatic framing, AI is recognized as an important driver of research efficiency and innovation, but ethical and infrastructural considerations remain part of the discussion.

India’s sentiment profile is strongly positive overall, with values frequently exceeding 3.0 and even reaching the maximum score, 5.0 in December 2024. This indicates a highly optimistic national narrative about AI’s role in democratizing education and advancing research capacity. The only notable dips, like 1.2 in April 2025, may reflect the inclusion of articles discussing uneven technological access or teachers worrings.

Italy displays steady positivity, with most months between 2.0 and 4.0. The strong peak in August 2024 (4.3) suggests heightened media attention to successful educational uses of AI, perhaps linked to university-level adoption or public innovation campaigns. Occasional

declines, like in February 2025 at 0.6, imply that Italian coverage, while mostly enthusiastic, also acknowledges concerns related to ethics and regulation.

Japan shows high variability in sentiment, reflecting contrasting viewpoints in the national debate on AI in education. While August 2024 records a sharp negative score (-2.0), sentiment becomes very positive by January 2025 (4.0). This duality likely represents cultural ambivalence, excitement about technological progress in education coexisting with apprehension over depersonalization of learning.

Russia maintains a consistently positive and stable pattern, with sentiment values oscillating between 1.5 and 3.2. The narrow SEM intervals suggest relatively homogeneous coverage, portraying AI as a supportive tool for scientific and educational modernization, and also a high number of articles. Russian media appear less polarized on this topic than on other frames, reflecting a state-driven narrative emphasizing the strategic benefits of AI research.

The United Kingdom shows strong oscillations, alternating between highly positive and strongly negative peaks. After a surprising dip to -4.0 in July 2024, sentiment rebounds sharply to 5.0 in August and remains positive through much of late 2024 and early 2025. These swings reflect the polarized discourse around generative AI in education, balancing concerns about academic integrity with enthusiasm for efficiency and accessibility in research and learning environments.

The United States demonstrates a mixed but slightly positive sentiment, generally between 0 and 2.0, with occasional extremes, such as -2.0 in November 2024 and 4.0 in March 2025. The volatility and large SEM intervals indicate a small number of articles with this frame.

Overall, Figure 24 indicates that the “AI transformations in education and research” frame is among the most positively perceived across the dataset, suggesting widespread optimism about AI’s benefits for learning and scientific advancement. Nonetheless, the variability across countries, and the relatively high SEMs in some contexts, reveal that media narratives remain dynamic and context-dependent, shaped by local educational systems, cultural values, and stages of AI policy implementation.

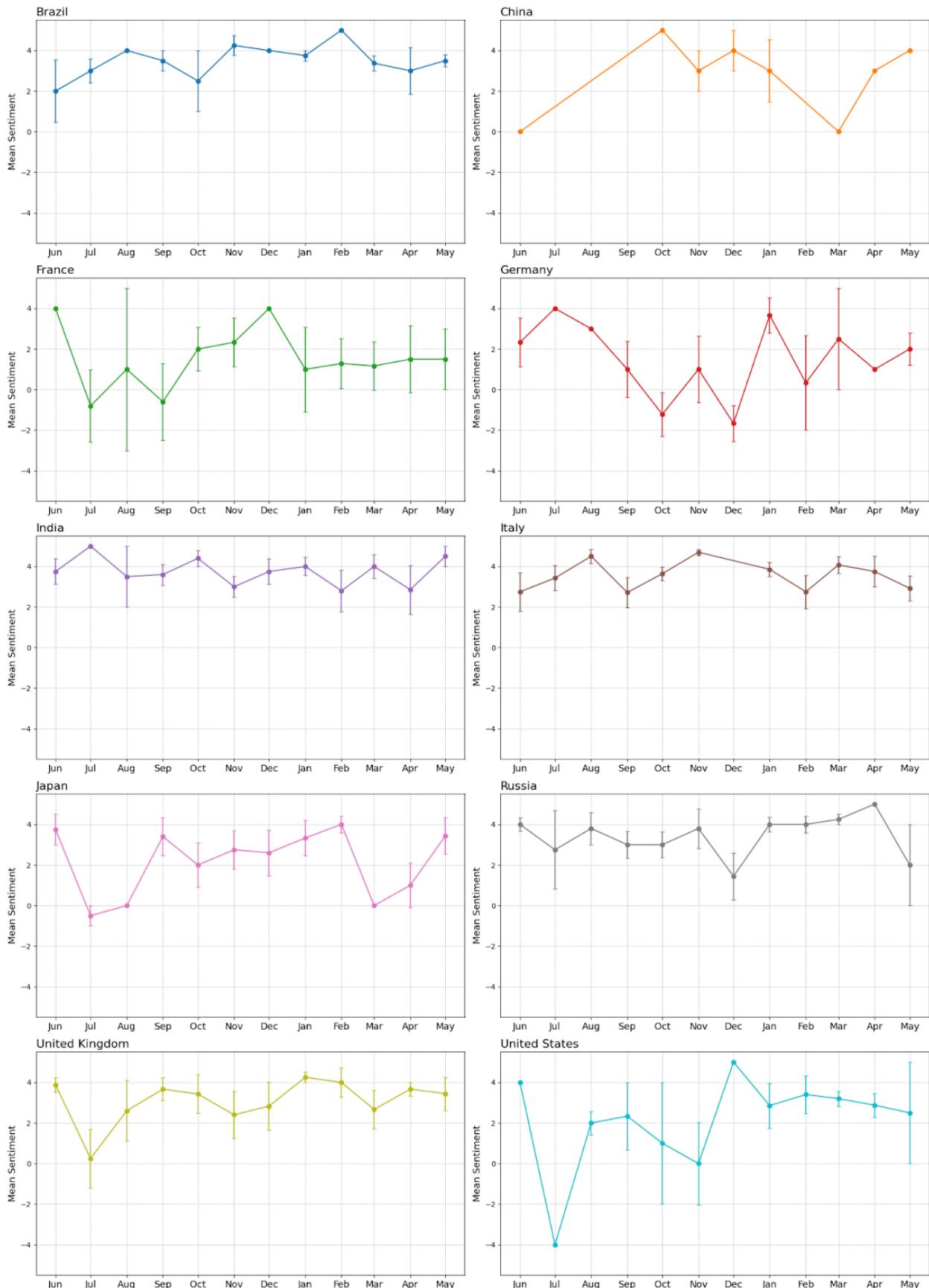


Figure 25: “AI in healthcare and climate change” frame monthly mean sentiment with standard error confidence intervals by country

Figure 25 illustrates the monthly evolution of the “AI in healthcare and climate change” frame’s mean sentiment, together with standard error of the mean (SEM) confidence intervals, across the ten countries. This frame captures media narratives that highlight how artificial intelligence contributes to medical innovation and climate change mitigation, two domains where technological optimism and ethical caution often coexist.

Overall, the sentiment is strongly positive across nearly all countries, indicating that AI applications in healthcare and environmental sustainability are perceived as socially beneficial and transformative. Many countries exhibit mean sentiment scores consistently above 3.0, suggesting enthusiastic media portrayals emphasizing medical breakthroughs, improved diagnostics, or AI’s role in addressing global environmental challenges. However, variations in sentiment and SEM across months suggest that the intensity of optimism fluctuates, reflecting national differences in technological capacity, ethical debates, and local reporting priorities, and it also indicates the low number of articles with this frame.

Brazil shows a consistently positive trajectory, with sentiment values mostly ranging between 3.0 and 5.0. The sentiment peaks in February 2025 at 5.0, reflecting particularly favorable coverage, possibly linked to AI’s use in public health programs or sustainability projects. The small SEM intervals across several months indicate a high level of agreement among articles, suggesting a unified narrative of technological optimism, but also a sufficient amount of articles. Occasional dips, like in October 2024 at 2.5, may correspond to more critical or investigative reporting.

China exhibits a highly optimistic but sparse pattern, with several missing months and abrupt shifts between 0 and 5.0. Positive peaks likely correspond to policy announcements or technological milestones, such as AI-driven climate modeling or healthcare innovations. The limited variability and frequent missing SEM intervals are due to the small sample size.

France displays greater volatility, with sentiment oscillating between strongly positive (4.0) and slightly negative values (-0.8). These fluctuations likely reflect France’s critical engagement with technology, balancing enthusiasm for AI in healthcare innovation with public debate over privacy, ethics, and data security. The large SEM intervals indicate diverse perspectives within the national press and a lack of data.

Germany presents a mixed sentiment pattern, alternating between positive peaks, such as 4.0 in August 2024 and 3.7 in January 2025, and negative dips, like -1.2 in October 2024 and -1.7 in December 2024. This suggests a nuanced and occasionally skeptical national discourse, consistent with German media’s frequent focus on AI governance, privacy, and medical accountability. The high SEM values reflect heterogeneity in coverage, and a lack of data.

India consistently demonstrates very high sentiment values, with means typically between 3.0 and 5.0, culminating in the maximum score of 5.0 in July 2024 and 4.5 in May 2025. The low SEM intervals confirm a strong consensus across Indian media portraying AI as a key enabler of healthcare innovation and sustainable development, and that several articles with this frame are present. These results align with India’s growing investment in digital health and environmental monitoring technologies.

Italy also displays a sustained positive trend, with sentiment frequently above 3.0 and peaking in November 2024 (4.7). Italian coverage appears particularly enthusiastic regarding

AI's potential in medical diagnostics and environmental forecasting, with very small SEMs in several months, signaling consistent reporting and large coverage. Occasional moderation in sentiment, like in February 2025 at 2.8, suggests balanced coverage incorporating both benefits and practical challenges of implementation.

Japan reveals a moderately positive pattern with notable variability, from a brief negative phase in mid-2024 (-0.5) to a recovery toward high positive sentiment, with 4.0 in February 2025. This pattern suggests that Japanese media initially approached AI's medical and ecological roles cautiously, possibly debating ethical risks, before adopting a more favorable tone as practical applications demonstrated reliability and impact.

Russia shows sustained positivity throughout the period, with sentiment consistently between 3.0 and 5.0, peaking at 5.0 in April 2025. The generally low SEMs point to homogeneous coverage and a stable narrative portraying AI as a driver of national technological progress in both medical and environmental domains. Only a few months show higher uncertainty, like July 2024, reflecting episodic debate or fewer articles.

The United Kingdom presents stable and positive sentiment, averaging around 3.5 across most months, with small SEM intervals in several periods. Occasional dips, like 0.25 in July 2024, coincide with increased public scrutiny over AI ethics in healthcare or the climate sector. Overall, British coverage remains confident but nuanced, reflecting mature debate within a media landscape attentive to both innovation and regulation.

The United States displays the widest sentiment fluctuations, from a sharp negative outlier, such as -4.0 in July 2024, to strong positivity, like 5.0 in December 2024. This oscillation reflects polarized media discourse, typical of U.S. reporting on AI, combining enthusiasm about transformative potential with skepticism regarding corporate responsibility, data misuse, and bias in health applications. The large SEM intervals in several months suggest significant heterogeneity in news tone across different outlets and a low number of articles for this frame.

In sum, Figure 25 underscores that the “AI in healthcare and climate change” frame is one of the most optimistic topics in global AI reporting. Despite national differences, the dominant narrative emphasizes hope and progress, portraying AI as a vital tool for solving complex global challenges related to human health and the environment. Nevertheless, variability in mean sentiment and SEM indicates that the intensity of optimism is context-dependent, with more cautious tones emerging in countries where ethical, privacy, or inequality concerns receive greater journalistic attention.

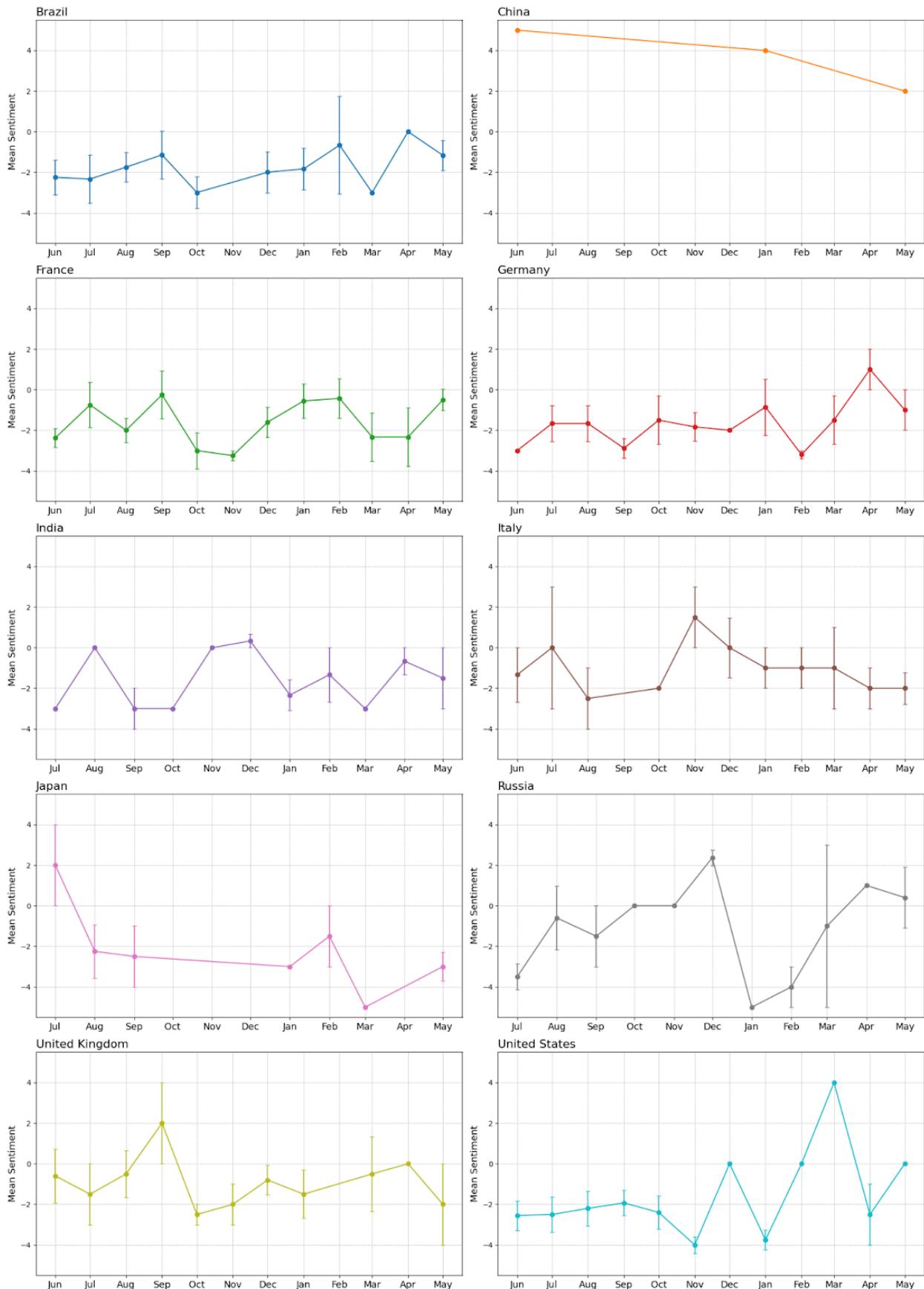


Figure 26: “AI in politics, elections, and public opinion” frame monthly mean sentiment with standard error confidence intervals by country

Figure 26 illustrates the evolution of sentiment in media coverage of the “AI in politics, elections, and public opinion” frame across the ten countries, showing mean sentiment scores with standard error of the mean (SEM) confidence intervals. This frame addresses narratives around AI’s role in shaping democratic processes, influencing voter behavior, managing public opinion, and spreading disinformation.

Overall, the sentiment is predominantly negative across most countries, reflecting widespread media concern about AI’s potential to undermine democratic integrity, enable manipulation, and amplify misinformation. In contrast to the more optimistic frames on AI in healthcare or education, this topic evokes apprehension, ethical debate, and political tension. Occasional positive months or isolated peaks tend to correspond to discussions of regulatory progress or successful use of AI for transparency and governance rather than unreserved enthusiasm.

Brazil displays a consistently negative pattern, with mean sentiment ranging mainly between -3.0 and -1.0 throughout 2024–2025. The lowest point appears in October 2024 (-3.0), suggesting heightened anxiety, possibly linked to electoral controversies or concerns about online misinformation. The trend slightly improves by early 2025, with 0.0 in April, suggesting a mild normalization or the emergence of more neutral reporting. The moderate SEM values indicate relatively consistent coverage across outlets, dominated by cautionary tones, and a moderate number of articles.

China represents an outlier with entirely positive sentiment, featuring high means of 5.0 in June 2024, 4.0 in January 2025, and 2.0 in May 2025. This exceptional positivity likely reflects state-controlled narratives emphasizing AI’s role in administrative efficiency, data governance, or political stability rather than open criticism. The absence of SEM values indicates limited data points.

France exhibits a strongly negative but variable pattern, with recurring low values, like -3.0 in October and -3.3 in November 2024, and intermittent partial recoveries in early 2025. These oscillations suggest a dynamic and critical discourse, alternating between warnings about disinformation and discussions of policy responses. The relatively small SEM intervals indicate agreement among outlets in negative framing, consistent with France’s active debate on digital ethics and regulation of online political communication, but also a sufficient number of articles.

Germany also maintains predominantly negative sentiment, with values clustering between -3.0 and -1.0 . The lowest points occur in June 2024 (-3.0) and February 2025 (-3.2), corresponding to strong concern over AI-driven misinformation or election interference. Notably, sentiment temporarily rises to positive territory in April 2025 (1.0), possibly due to favorable coverage of regulatory or transparency initiatives. SEM values vary moderately, showing that while the tone is mostly negative, there are occasional contrasting perspectives, or a not elevated number of articles.

India shows a generally negative to neutral trend, oscillating between -3.0 and 0.0 . The mid-2024 months are clearly pessimistic, reflecting concerns about misinformation, deepfakes, and AI’s influence on electoral discourse. By early 2025, the sentiment slightly moderates between -0.7 and -1.5 , and isolated neutral values, like 0.0 in August and November 2024, suggest temporary shifts in focus toward regulatory discussions or

AI-driven civic engagement. SEM values around 1.0–1.5 show moderate uncertainty, indicating diverse coverage and a lack of articles.

Italy displays mixed but mostly negative sentiment, ranging from –2.5 to –1.0, with only a few months approaching neutrality, like July and December 2024. A short positive episode in November 2024 (1.5) may reflect coverage of ethical AI initiatives or governance debates. Overall, the Italian press appears skeptical but less extreme than the Anglo-American or German cases, balancing caution with occasional constructive narratives.

Japan reveals a predominantly negative sentiment, with extreme lows, with –5.0 in March 2025, indicating heightened criticism or alarm about AI's political implications. The mid-2024 months include one outlier of mild positivity, which is 2.0 in July, but the trend rapidly turns negative, stabilizing between –3.0 and –2.5 later in the period. Large SEMs suggest variation in tone, possibly reflecting differences between national and international outlets, but also a low number of articles with this frame.

Russia shows highly variable sentiment, swinging from strong negativity, with –5.0 in January 2025, to temporary positivity, with 2.4 in December 2024. This fluctuation may stem from contrasting narratives between domestic and foreign-oriented media, some celebrating AI's potential in public administration, others acknowledging risks related to manipulation or propaganda. High SEMs in several months indicate heterogeneous reporting and a lack of articles.

The United Kingdom demonstrates alternating patterns with a mostly negative tone in fall 2024 interrupted by brief positive or neutral months, like 2.0 in September 2024 and 0.0 in April 2025. This suggests a balanced discourse, while skepticism dominates, British media also highlight opportunities for AI-assisted transparency, data-driven governance, or electoral oversight. The large SEMs indicate significant variation among outlets and small coverage.

The United States stands out for its persistent negativity, averaging around –2.5 to –4.0 through most of the period, consistent with domestic debates on deepfakes, misinformation, and election interference. A temporary positive spike in March 2025 (4.0) likely corresponds to isolated optimistic reporting, perhaps linked to regulatory initiatives or technological countermeasures against AI-generated misinformation. The narrow SEMs during negative months suggest broad consensus in U.S. media about the risks associated with AI's political use and a large coverage in that period.

In summary, Figure 26 depicts “AI in politics, elections, and public opinion” as one of the most negatively perceived frames across countries, dominated by narratives of risk, manipulation, and ethical danger. With the notable exception of China, all countries exhibit sustained concern and caution. Occasional positive or neutral shifts are linked to governance or transparency measures rather than enthusiasm for AI itself. The consistently negative sentiment across most contexts highlights that political applications of AI remain a domain of distrust and regulatory anxiety, rather than one of optimism or technological celebration.

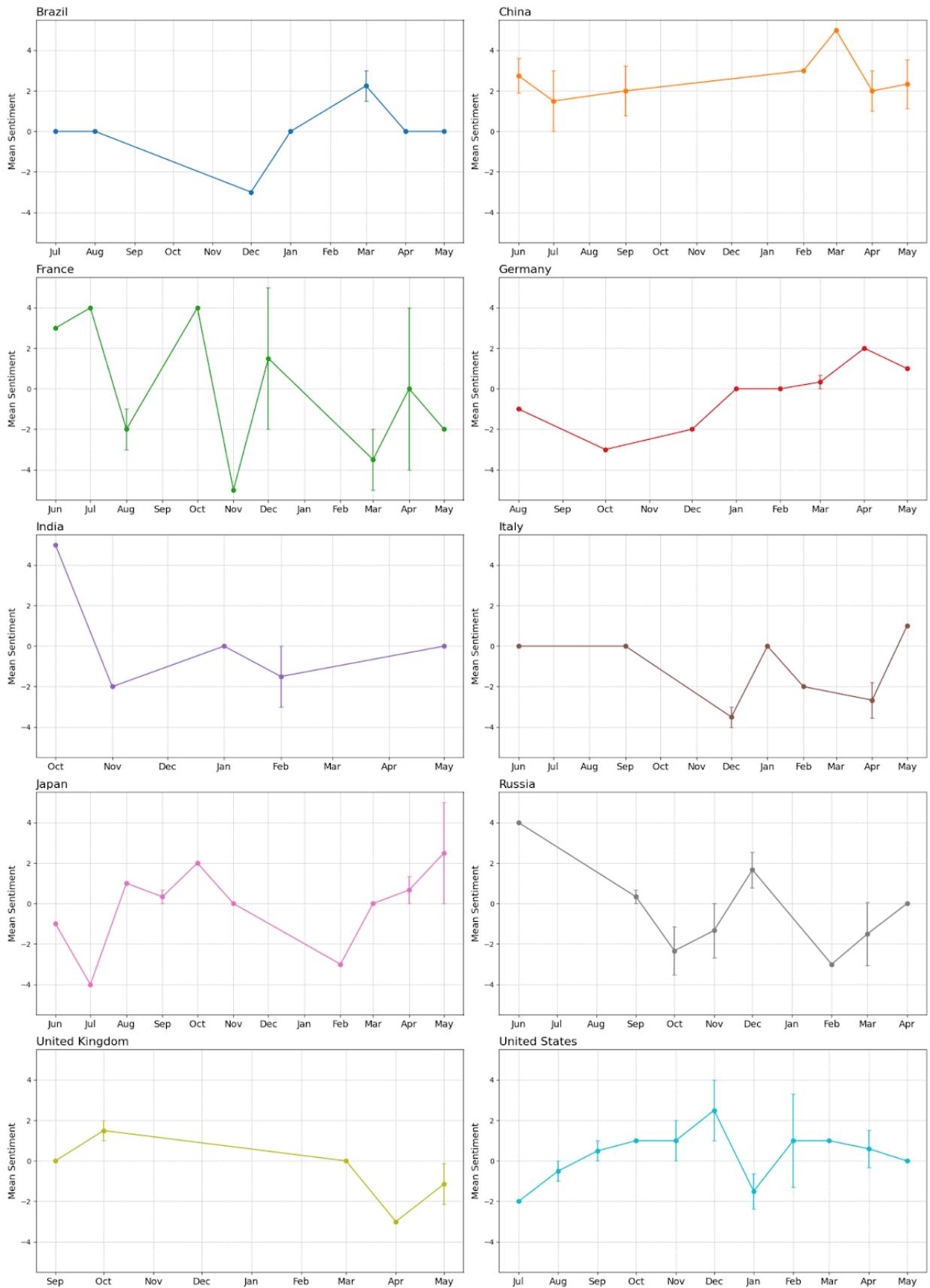


Figure 27: “Other” frame monthly mean sentiment with error confidence intervals by country

Figure 27 presents the temporal evolution of sentiment for the “Other” frame across countries, together with the standard error of the mean (SEM) representing the uncertainty of each monthly average. This residual frame encompasses topics related to AI that did not fit into the main thematic categories. Given the heterogeneous nature of these stories and the smaller number of observations, the resulting series are often irregular, with large gaps, fluctuating means, and missing SEM values, which limit the interpretability of monthly trends.

Overall, sentiment within the “Other” frame is mixed and inconsistent, with alternating positive and negative values across countries and months, suggesting that coverage is driven by isolated events rather than sustained narratives. The high variance and frequent absence of data indicate low article counts and high uncertainty in several months.

Brazil shows a mostly neutral to slightly positive trend, with means near 0 in most months and a brief increase in March 2025 (2.3), indicating a temporary shift toward positive coverage. This variability, coupled with frequent zero or missing SEMs, suggests sporadic and limited reporting.

China maintains a consistently positive sentiment, ranging from 1.5 to 5.0, reflecting an overall optimistic framing of AI topics. The highest point, with 5.0 in March 2025, likely corresponds to coverage celebrating technological achievements or government initiatives. SEM values, when available, are moderate, implying some variability but still a generally favorable discourse.

France displays high volatility, alternating between strong positive, such as 4.0 in July and October 2024, and strong negative sentiment, like -5.0 in November 2024, and -3.5 in March 2025. This pattern points to polarized narratives, possibly combining optimistic stories about AI innovation with sharply critical ones about ethical or societal risks. The large SEMs in some months confirm considerable heterogeneity among sources and a lack of articles.

Germany shows a shift from negative sentiment in late 2024 (-3.0), to mildly positive or neutral tones in early 2025 (0.3). The increase from winter to spring suggests a change in media focus, perhaps toward more constructive or less controversial uses of AI. However, the frequent lack of SEMs indicates limited data points.

India alternates between extremes, with a very positive month in October 2024 (5.0) followed by negative ones, like -2.0 in November and -1.5 in February 2025. This variability again reflects episodic reporting, where sentiment depends on the specific nature of the few covered events rather than sustained public discourse.

Italy maintains a generally negative sentiment, with notable lows in December 2024 (-3.5) and April 2025 (-2.7). Occasional neutral or slightly positive observations, like 1.0 in May 2025, do not offset the overall skeptical tone. Moderate SEMs when present indicate some variation but not major disagreement among sources.

Japan shows one of the widest sentiment ranges, spanning from highly negative, like -4.0 in July 2024, to positive, with 2.5 in May 2025. This bimodal behavior suggests alternating coverage between criticism and enthusiasm, possibly reflecting cultural or industrial diversity in AI-related reporting.

Russia presents substantial month-to-month swings, with values from 4.0 in June 2024 to –3.0 in February 2025. The alternation between positive and negative peaks may reflect the coexistence of state-promoted optimism about AI development and critical reporting on geopolitical or ethical issues. SEM values vary widely, reinforcing the interpretation of fragmented coverage, but also a lack of data.

The United Kingdom displays mixed sentiment, with mild positivity in October 2024 (1.5) and more negative tones in early 2025 (–3.0). The near-zero mean in several months, like September 2024 and March 2025, suggests a lack of strong emotional framing, consistent with limited attention to off-topic AI stories.

The United States shows slight overall positivity, oscillating between –2.0 and 2.5. The early months are more negative, while late 2024 and early 2025 exhibit mild optimism (2.5). The presence of multiple SEM values above 1.0 indicates considerable variation among outlets, likely reflecting the diversity of U.S. media coverage and a lack of data.

In summary, the “Other” frame displays no coherent global trend, with countries alternating between positive, neutral, and negative sentiment. These fluctuations largely reflect the sporadic, low-frequency nature of the underlying coverage, where each monthly mean is influenced by a small number of articles addressing diverse AI-related topics. The wide or missing SEM intervals confirm that results for this frame should be interpreted cautiously, as they primarily capture residual and event-driven variation rather than stable thematic attitudes toward AI.

5.3. Frame and sentiment prediction

First, the frame prediction using NLP with machine learning is being displayed in the following table and figure.

Table 6: NLP prediction of maintext frames using logistic regression and random forest classifier

| Country | Logistic Regression | | | Random Forest Classifier | | |
|---------|---------------------|--------------|-----------------|--------------------------|--------------|-----------------|
| | Accuracy | Macro avg f1 | Weighted avg f1 | Accuracy | Macro avg f1 | Weighted avg f1 |
| Brazil | 0.57 | 0.36 | 0.52 | 0.57 | 0.35 | 0.52 |
| China | 0.52 | 0.20 | 0.47 | 0.56 | 0.27 | 0.53 |
| France | 0.49 | 0.34 | 0.45 | 0.48 | 0.36 | 0.46 |
| Germany | 0.49 | 0.30 | 0.43 | 0.47 | 0.28 | 0.41 |
| India | 0.56 | 0.41 | 0.54 | 0.55 | 0.41 | 0.53 |

| | | | | | | |
|----------------|------|------|------|------|------|------|
| Italy | 0.54 | 0.38 | 0.50 | 0.51 | 0.33 | 0.46 |
| Japan | 0.40 | 0.09 | 0.32 | 0.39 | 0.11 | 0.34 |
| Russia | 0.48 | 0.35 | 0.45 | 0.49 | 0.40 | 0.48 |
| United Kingdom | 0.57 | 0.37 | 0.52 | 0.54 | 0.34 | 0.48 |
| United States | 0.47 | 0.36 | 0.42 | 0.45 | 0.35 | 0.39 |
| All Countries | 0.50 | 0.39 | 0.48 | 0.51 | 0.42 | 0.48 |

The results of the frame prediction models show moderately good overall performance, indicating that traditional NLP classifiers can partially, but not fully, replicate the complex framing distinctions identified by Large Language Models. Using TF-IDF features as predictors and the LLM-assigned frame labels as the target variable, both logistic regression and random forest classifiers achieved accuracies generally between 0.45 and 0.57 across countries. The macro-averaged F1-scores, which account for imbalanced class distributions, were typically lower (0.20–0.42), suggesting that the models performed better on dominant frames than on less frequent ones. The weighted F1-scores, which adjust for class size, ranged between 0.39 and 0.54, reinforcing that prediction quality varied depending on frame prevalence.

Cross-nationally, the United Kingdom, India, and Brazil showed the best overall results, with accuracies around 0.55–0.57 and balanced F1-scores, likely reflecting the richer lexical diversity and better alignment of the TF-IDF representation with English and Portuguese text structures. In contrast, Japan, Germany, and France exhibited the weakest performance, with accuracies near 0.40–0.49 and macro F1 values below 0.35, indicating difficulties in distinguishing between frames in linguistically diverse corpora. Among models, random forest classification provided slightly higher F1-scores in most cases, capturing non-linear relationships between terms and frame categories, although the improvement over logistic regression remained modest.

Overall, these findings suggest that lexical-based NLP models can approximate LLM-generated frame labels only to a limited extent, performing best in languages and datasets with consistent vocabulary and larger sample sizes. The general performance, although moderately good, highlights the limitations of traditional feature-based approaches for high-level semantic tasks such as framing analysis, where context, narrative tone, and discourse structure play crucial roles.

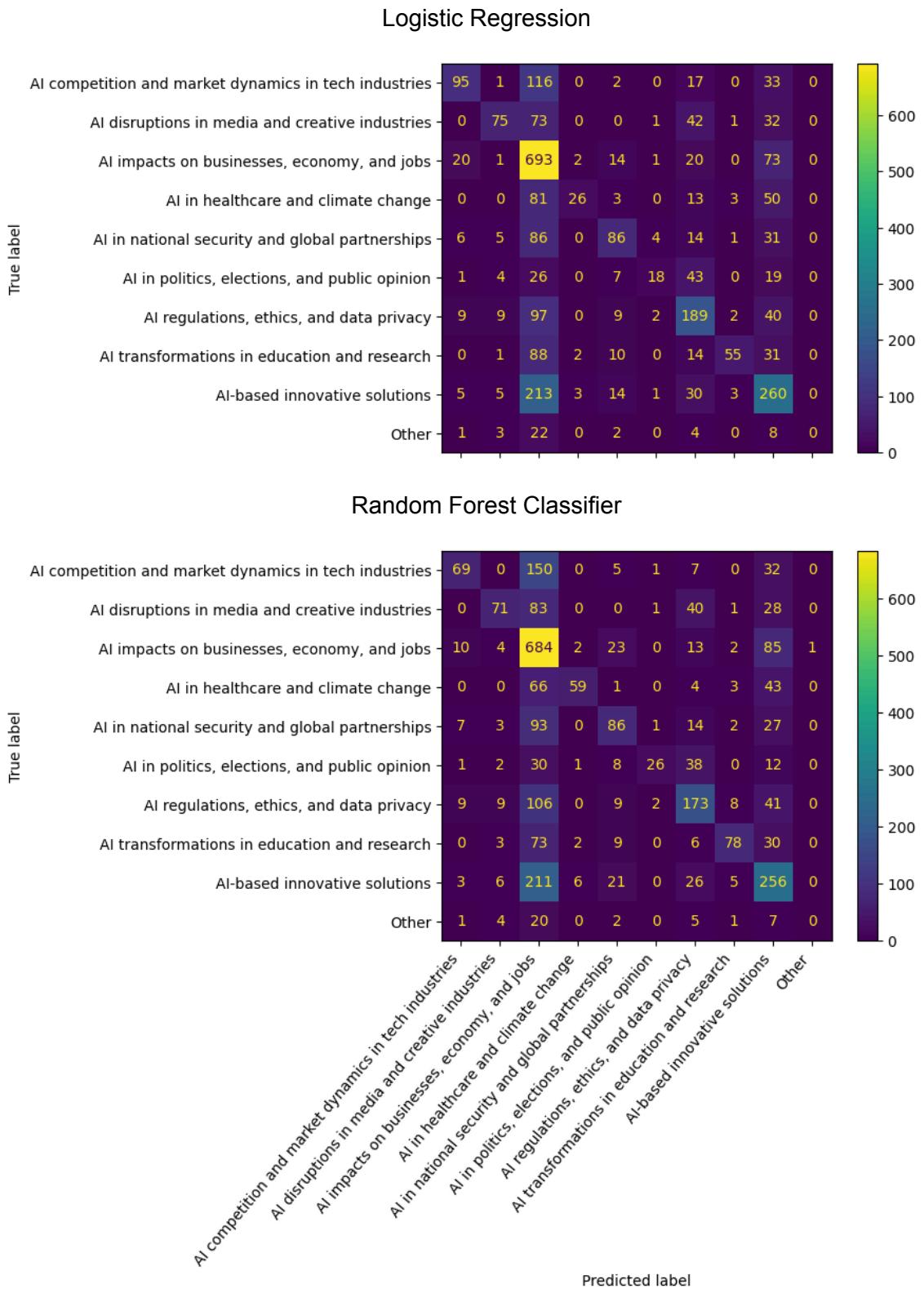


Figure 28: Confusion matrices of NLP prediction of frame using logistic regression and random forest classifier for all countries dataset.

Looking at the confusion matrices, it is possible to see that the machine learning models perform moderately well, although the most frequent class tends to be predicted too much.

This indicates that the models perform best on balanced datasets compared to datasets with certain classes more frequent than others.

Following, the sentiment prediction is being displayed for each country in the following table.

Table 7: NLP prediction of maintext sentiment using linear regression and random forest regressor

| Country | Linear Regression | | | Random Forest Regressor | | |
|----------------|-------------------|------|----------------|-------------------------|------|----------------|
| | MSE | MAE | R ² | MSE | MAE | R ² |
| Brazil | 4.55 | 1.67 | 0.40 | 5.48 | 1.89 | 0.28 |
| China | 3.62 | 1.43 | -0.05 | 3.53 | 1.46 | -0.02 |
| France | 8.12 | 2.25 | 0.18 | 7.22 | 2.31 | 0.27 |
| Germany | 331 | 137 | -369 | 7.20 | 2.25 | 0.19 |
| India | 4.60 | 1.73 | 0.46 | 5.73 | 1.88 | 0.33 |
| Italy | 5.36 | 1.86 | 0.33 | 6.10 | 1.96 | 0.24 |
| Japan | 12.73 | 2.88 | -0.74 | 6.68 | 2.15 | 0.09 |
| Russia | 5.90 | 1.92 | 0.32 | 6.54 | 2.08 | 0.24 |
| United Kingdom | 5.87 | 1.89 | 0.46 | 6.93 | 2.14 | 0.36 |
| United States | 6.90 | 2.09 | 0.23 | 6.64 | 2.09 | 0.25 |
| All Countries | 33.6 | 4.28 | -2.73 | 6.08 | 2.03 | 0.32 |

The results of the sentiment prediction models reveal notable differences in predictive performance across countries and between model types. Linear regression and random forest regressors were both trained to predict sentiment scores on a continuous scale from -5 to +5, using TF-IDF features derived from the articles' main texts. Overall, linear regression tended to achieve slightly higher explanatory power, while the random forest regressor showed more stable but modest performance. The mean squared error (MSE) values for most countries remained in the range of 4.0 to 7.0, corresponding to an average deviation of about 2.0 sentiment points.

Cross-country comparisons suggest that predictive accuracy is influenced by both linguistic and data-related factors. English-language datasets (United Kingdom and India) reported the best results, likely due to richer linguistic resources and more balanced data

distributions. In contrast, performance was substantially weaker for non-English corpora such as Japanese and Chinese news, where differences in syntax, sentiment expression, and tokenization likely reduced model efficiency. The anomalously high MSE for Germany (331) and negative R² values for China and Japan indicate model instability, even by testing different parameters, possibly driven by outlier distributions in sentiment annotations.

While the random forest regressor captured some nonlinear patterns missed by the linear model, its improvement was limited, suggesting that lexical sentiment features alone may not fully capture the semantic nuance of AI-related discourse. These results underscore the limitations of traditional NLP models when handling multilingual and context-dependent sentiment data, especially compared to LLM-based annotations that can incorporate contextual and cross-sentential meaning. The models demonstrate that sentiment prediction based on textual features are not feasible, at least for what was found in these results.

6. Conclusions

This study explored how Artificial Intelligence (AI) is framed in the media and the sentiment associated with it across ten countries, integrating large language model (LLM) for frame and sentiment detection, lexicon-based method, and topic modeling. The goal was to identify dominant narratives and their evolution over time, to understand both the cross-national patterns and the sentiment tone associated with AI coverage.

Overall, the findings reveal that economic and innovation-oriented frames dominate global media discourse about AI. The most prevalent frames were “AI impacts on businesses, economy, and jobs” and “AI-based innovative solutions,” together accounting for nearly half of all coverage. This aligns with previous research showing that media narratives on AI often emphasize technological progress and economic growth (Cave et al., 2019; Chuan, Tsai, & Cho, 2019; Brennen, Howard, & Nielsen, 2018). Like these earlier studies, this work confirms that industry-led and corporate perspectives continue to shape public discourse, with limited attention to legal or ethical dimensions. However, while Ittefaq et al. (2025) and Wang et al. (2023) documented a growing balance between innovation and ethics frames in Western outlets, the present findings suggest that such equilibrium remains incomplete, economic and innovation frames still substantially outweigh normative discussions on regulation and governance.

Frame frequencies revealed both global consistencies and distinct national patterns in AI coverage. Across most countries, economic and innovation-oriented frames dominated, with “AI impacts on businesses, economy, and jobs” and “AI-based innovative solutions” consistently ranking as the two most frequent frames. However, their relative prominence varied. Japan, Germany, and the United Kingdom showed particularly high shares of business and economy-related framing, suggesting a strong alignment between media narratives and industrial competitiveness discourses, echoing Brennen et al.’s (2018) observations of industry-driven reporting in the UK. In contrast, countries like China devoted more attention to AI in national security and global partnerships, reflecting the state-led modernization and technological sovereignty emphasis described by Ji, Kuai, and Zamith (2024) and Zeng et al. (2021). Other European countries, such as Italy and France, presented a more balanced frame distribution, where innovation narratives coexisted with discussions on AI regulation,

education, and research. Meanwhile, “AI in politics, elections, and public opinion” was relatively underrepresented across all countries, indicating that governance and accountability concerns remain secondary compared to narratives emphasizing technological and economic progress. This finding resonates with the broader conclusion by Ittefaq et al. (2025) that media globally prioritize opportunity frames over risk or ethics frames, especially outside Anglophone contexts.

The LLM-based frame classification produced coherent and interpretable categories that largely overlapped with those emerging from topic modeling, though with greater conceptual precision. While topic modeling highlighted clusters such as “business applications,” “AI regulation,” and “education and innovation,” the LLM approach was able to assign more nuanced interpretive labels, capturing frames that combined technological, ethical, and geopolitical aspects. This comparison confirms that LLM-based methods can complement traditional unsupervised techniques by providing semantically richer frame detection, an advancement consistent with recent calls in computational communication research to test transformer-based and generative models for automated annotation (Allaham, Kieslich, & Diakopoulos, 2025; Xian et al., 2024). The methodological comparison thus contributes to closing a gap identified in the literature, the limited evaluation of LLMs against established NLP pipelines in multilingual media analysis.

Sentiment analysis added another interpretive layer, showing that most AI-related frames are covered positively, particularly those linked to innovation, healthcare, research, and business transformation. Conversely, discussions with “AI in politics, elections, and public opinion” and “AI in regulations, ethics, and data privacy” frames were more negative, suggesting that media portrayals balance enthusiasm for AI’s benefits with concern over its societal implications. This mirrors the duality found in previous studies, with early optimism and progressivism (Garvey & Maskal, 2020; Vergeer, 2020) contrasted with recent waves of “AI anxiety” and critical narratives (Sanguinetti & Palomo, 2024; Ryazanov, Öhman, & Björklund, 2024). Yet, while those works observed a marked negative turn following generative AI’s rise, the present findings reveal that overall sentiment remains net positive, with fluctuations rather than a sustained decline. This indicates that, although generative AI triggered critical reflection, optimism toward AI’s transformative potential continues to dominate global media discourse. Indeed, all the analyzed countries report an overall positive sentiment, although cross-national differences exist. China reports the most positive mean sentiment, followed by Japan, Italy and India. Russia, Brazil, United Kingdom, and United States have a more mildly positive overall sentiment, and lastly Germany and France display an overall sentiment that is closer to being neutral, even though still positive.

Temporal trends revealed short-term variability, likely linked to specific country-related events, such as policy implementation or innovation announcements, which temporarily increased or decreased the frequency of certain frames and the sentiment associated with them. Despite these fluctuations, sentiment across most frames remained within a positive to neutral range, suggesting a persistent optimism in the global AI narrative. However, the differences in sentiment polarity between emerging and Western economies underscores how local sociopolitical contexts mediate media perceptions of AI’s societal role. This cross-national divergence reinforces the findings of Wang, Downey, and Yang (2023) and Ittefaq et al. (2025), who showed that Global South media emphasize progress and opportunity, whereas Global North outlets stress regulation and risk. The current analysis thus

confirms that the geography of AI discourse maps onto broader structural differences in technological capability, policy orientation, and national self-image.

The NLP predictions using machine learning models produced moderately good results for frame prediction, leaving open the possibility for future work on supervised frame classification using labeled datasets. On the other hand, sentiment prediction performed poorly, suggesting that predicting sentiment with this methodology is not yet feasible. This outcome, combined with the poor performance of the lexicon-based method Vader, aligns with methodological critiques in the literature (e.g., Thelwall, 2017; van Atteveldt et al., 2021), which note that context-sensitive, multilingual sentiment detection remains a significant challenge for automated systems.

In conclusion, the integration of LLM-based analysis, topic modeling, and NLP prediction offers a comprehensive framework for mapping AI media framing and sentiment. The findings suggest that while AI is predominantly portrayed as an engine of innovation and progress, concerns over ethics, privacy, and governance persist as counterpoints. These results confirm much of the existing literature while expanding it geographically and methodologically, providing one of the few comparative, multilingual analyses that combine framing, sentiment, and computational modeling. Future research could expand multilingual datasets beyond samples to full datasets, include new countries, and extend the temporal range to capture shifts across multiple years. Future research could also compare the evaluations of different LLMs to further advance the understanding of their reliability and interpretive depth for frame and sentiment classification.

7. Bibliography

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The code and data used for this study are available at:

https://github.com/TommasoGrotto2/Artificial_Intelligence_Media_Coverage_Analysis