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Who on Earth Is Using Generative AI?

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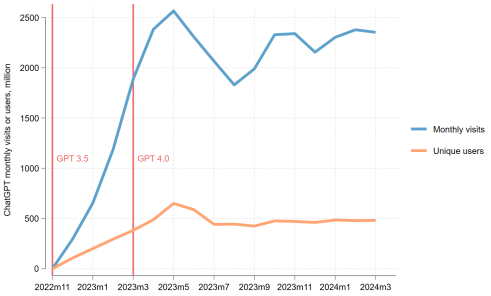
The Rapid Rise of Generative AI

- GenAI achieves in **months** what took other technologies **years**.
  - ChatGPT: 100 million users in 2 months (vs. 9 months for TikTok).
  - 500 million monthly users in April 2024 = 1/8 of global workforce.
- This paper presents the first global analysis of GenAI adoption, leveraging novel data sources including website traffic and Google Trends.
- Based on descriptive statistics and correlational regression analysis, this study provides fundamental insights into:
  - The profile of GenAI users across demographic, geographic, and usage dimensions.
  - Key drivers of GenAI adoption.



ChatGPT monthly visits and unique users

Key Findings

1. **Generative AI adoption surged rapidly, with ChatGPT as the dominant platform**
   - By April 2024, the top 40 GenAI tools attracted 3 billion monthly visits—over 80% from ChatGPT.
2. **Users skew young, male, and educated**
   - Strong weekday usage pattern: traffic drops by 40% on weekends, indicating work-related use.
3. **Middle-income economies account for half of global traffic**
   - Countries like India, the Philippines, Brazil, and Mexico show higher usage than GDP would predict.
   - However, usage intensity (visits per internet user) remains highest in high-income countries and strongly correlates with GDP per capita.
4. **Adoption is driven by infrastructure and skills**
   - Key predictors: internet infrastructure, service sector orientation, and English proficiency.
5. **GenAI is disrupting traditional information platforms**
   - Traffic to websites like Stack Overflow and Grammarly declined 15–40% post-GPT-4.
   - ChatGPT is increasingly replacing conventional online sources for learning-related tasks.

Contributions to the Literature

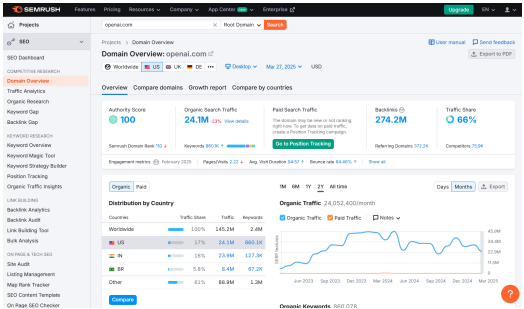
- **1. Measuring GenAI adoption across countries**
  - A growing literature and recent surveys have begun measuring GenAI adoption at the individual level and in firms, primarily in advanced economies (Humlum and Vestergaard 2024; Bick, Blandin, and Deming 2024; McClain 2024; Fletcher and Nielsen 2024; Bonney et al. 2024)
  - Broader AI adoption has been tracked through firm surveys, job postings, and patents (Acemoglu 2024; Babina et al. 2024; McElheran et al. 2024; Miric, Jia, and Huang 2023; Webb 2019)
  - Our paper offers the first global, real-time analysis of GenAI usage using website traffic and Google Trends, covering both advanced and developing countries.

- **2. Understanding the geography of technology diffusion**
  - Existing work links technology diffusion to income, infrastructure, and human capital (Keller 2004; Comin and Hobijn 2010; Czernich et al. 2011; Delera et al. 2022).
  - We identify key predictors of GenAI adoption intensity, including digital infrastructure, service economies and human capital.

- **3. Early impacts of GenAI**
  - Recent studies highlight GenAI's role in transforming task performance and productivity (Eloundou et al. 2023; Humlum and Vestergaard 2024; McClain 2024; Cui et al. 2024; Toner-Rodgers 2024)
  - We document potential behavioral substitution—e.g., declining traffic to traditional platforms—as users shift to GenAI for coding and learning tasks.

Data: Website Traffic from Semrush

- **Semrush**: A leading web analytics platform
- It monitors website traffic through clickstream analytics, tracking codes, and server logs.
- ML-based analytics:
  - **Usage metrics**: URL visits, unique users, and session duration.
  - **Geolocation**: Country-level attribution via IP address.
  - **Demographics**: Estimated from behavioral patterns.
- We obtained monthly data for each selected URL through the Semrush API in April 2024.



Semrush dashboard example

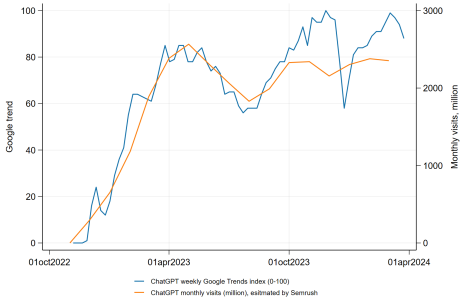
Advantages over surveys:

- **Spatial coverage**: Globally comparable metrics across 200+ economies, including hard-to-survey regions.
- **Temporal resolution**: Continuous, real-time monitoring of user behavior with daily granularity.
- **Additional benefits:**
  - Captures actual usage behavior without self-reporting bias.
  - Allows granular analysis by website and device type.
  - Covers a full range of users—from casual to intensive.

Limitations:

- **VPN usage** may distort geographic attribution, especially in small or island economies.
- **API/embedded usage** is not captured—usage via integrations (e.g., Siri, search engines, writing and coding platform) is not captured in website-level data.
- **Demographics** are behaviorally inferred, with no country-specific demographic breakdown as detailed as survey data.

- **Google Trends** :
  - ChatGPT traffic trends closely mirror global search interest over time.
  - Regression at country-month level confirms strong correlation — 0.64 elasticity between search and traffic.

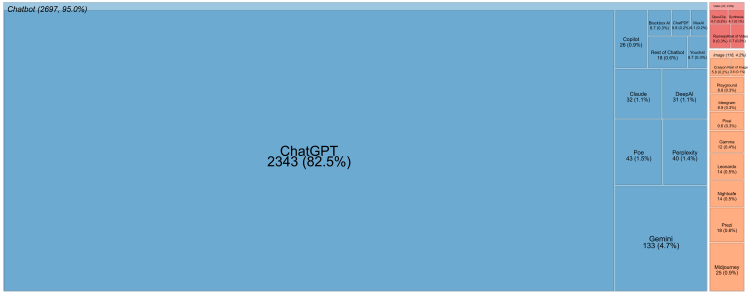


ChatGPT traffic vs. Google Trends

- **App downloads**: Mobile traffic trends align with app download data post-May 2023.
- **SimilarWeb comparison**: Traffic patterns are consistent with an alternative web analytics platform.

ChatGPT Dominates GenAI Web Traffic

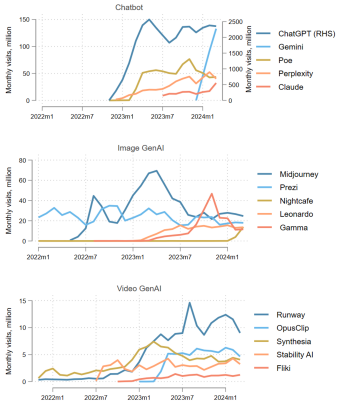
- We select the top 40 GenAI tools based on global traffic as of April 2024.
- ChatGPT accounts for over 80% of monthly visits across all tools.



Monthly visits (millions) of 40 selected GenAI tools, March 2024

Diverging Adoption Patterns Across GenAI Tool Types

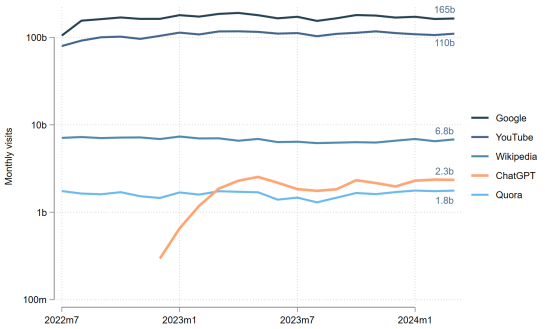
- While other GenAI tools gained traction, ChatGPT remains dominant—its scale far exceeds competitors like Gemini, Perplexity, and Claude.
- Image and video GenAI tools saw early surges but have plateaued, suggesting limited use cases beyond initial experimentation.
- New models with stronger reasoning and multimodal capabilities (e.g., DeepSeek, Grok, Claude 3, Cursor, GPT-4o,etc.), which emerged after March 2024, are actively reshaping usage patterns at scale.



Monthly traffic of GenAI tools by category

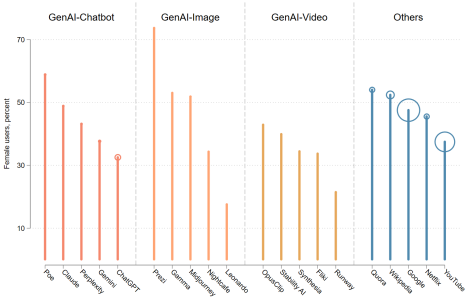
ChatGPT Compares to Other Leading Websites

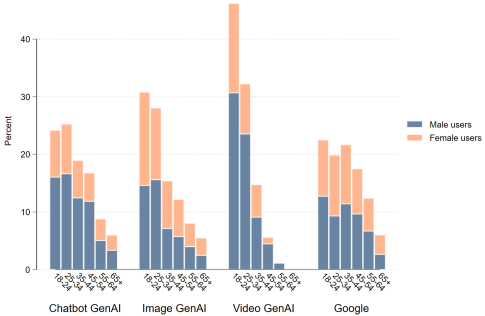
- ChatGPT surpassed Quora in traffic within four months of GPT-3.5's release.
- While notable, this is only 1/3 of Wikipedia's traffic and remains small compared to YouTube (110B) and Google (165B).



Monthly traffic comparison between ChatGPT and other leading websites

- Female users make up 33% of ChatGPT traffic, compared to 48% on Google.
- Strong age skew: 51%, 60%, and 76% of chatbot, image, and video tool users are under age 35.

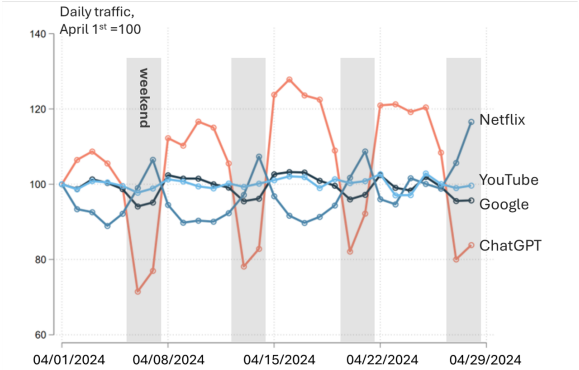




Gender and age distributions

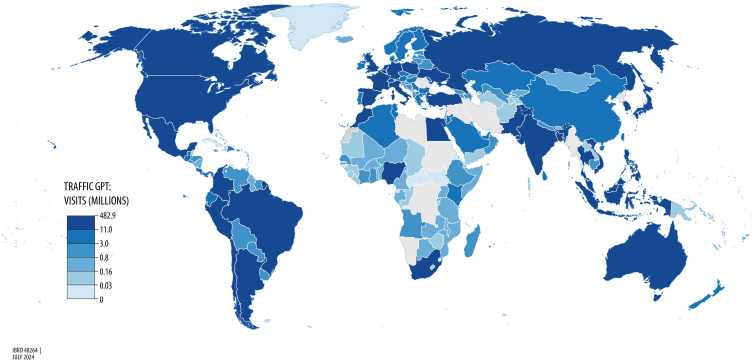
Who's Using GenAI?: Education and Work-Related Patterns

- 50% of chatbot users are college graduates, compared to 40% for Google.
- Strong weekday pattern suggests productivity-oriented behavior: ChatGPT traffic drops 40% on weekends.



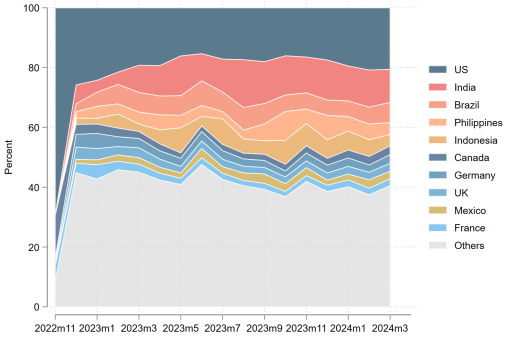
Daily traffic of ChatGPT and other leading websites (relative to Apr 1, 2024)

- ChatGPT reached users in 209 out of 218 economies within 16 months of its launch.



Geographic distribution of ChatGPT monthly visits, March 2024

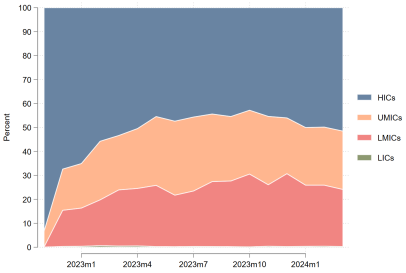
- Although ChatGPT originated in the US, its share of global traffic declined from 70% in the first month to below 25% in later months.
- Top 5: United States, India, Brazil, Philippines, and Indonesia — 4 of which are middle-income economies.



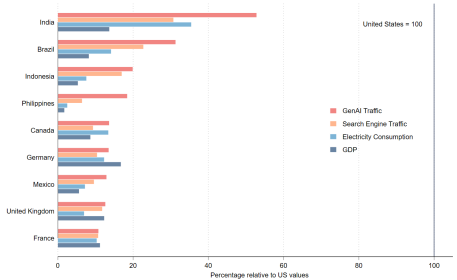
Share of ChatGPT monthly traffic by country

Who's Using GenAI?: Middle-Income Countries Outperform

- Middle-income countries account for roughly half of global ChatGPT traffic.
- Many generate more GenAI traffic than their economic and digital indicators imply.
  - India: 14% of US GDP, 35% and 30% of its electricity use and search traffic — yet 50+% of its GenAI traffic.
- GenAI demonstrates its potential as a digital equalizer, enabling middle-income countries to accelerate convergence in economic capabilities.

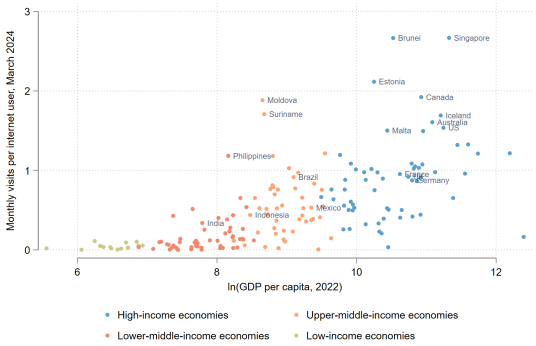


Traffic share by income group



ChatGPT traffic vs. GDP, electricity, and online search

- GenAI usage intensity (visits per internet user) remains highest in high-income countries.
- Usage intensity correlates strongly with GDP per capita, while a few middle-income countries stand out.

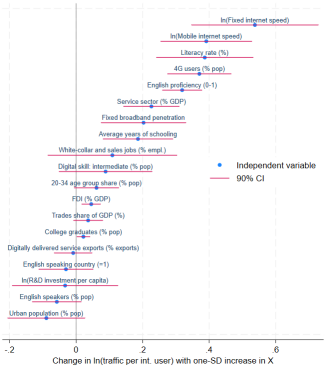


Monthly ChatGPT visits per internet user vs. GDP per capita (March 2024)

- We explore how country-level economic and digital factors relate to GenAI usage intensity with the following regression specification:

$$\ln(\text{Traffic per internet user})_{it} = \alpha X_{it} + \beta \ln(\text{GDP per capita})_{it-1} + \delta_t + u_{it}$$

  - i indexes countries; t is for year-quarter
  - X_{it} includes one country-level variable at a time
  - δ_t captures year-quarter fixed effects
- Better digital infrastructure coverage and quality, higher human capital, English proficiency, higher FDI inflows, a large services sector are strong correlated to GenAI usage intensity.



Regression results plots (one-by-one)

Note: Each coefficient from a separate regression. Standardized to show change in the dep. var. from a one-SD increase in the indep. var.

Drivers of GenAI Adoption (cont.)

- To address multicollinearity and improve predictive power, we use Lasso regression to select the most informative variables before running a full specification.
- Lasso selects 11 variables, grouped into three categories:
  - **Macroeconomic and demographic**: urban population share, youth share, service sector share, FDI share of GDP
  - **Digital infrastructure**: fixed and mobile internet speed, 4G user penetration
  - **Human capital**: English proficiency, literacy rate, college graduates, white-collar job share
- All selected variables are positively associated with ChatGPT usage intensity—except urban population share

Drivers of GenAI Adoption (cont.)

Dependent variable	ln(Quarterly ChatGPT traffic per internet user)						
	Total					Mobile	Desktop
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(Quarterly GDP per capita)	0.74***	0.31***	0.35***		-0.04	-0.60***	0.06
	(0.06)	(0.06)	(0.10)		(0.10)	(0.21)	(0.10)
20-34 age group share (% pop)	2.41**			5.29***	5.28***	2.67	7.11***
	(1.10)			(0.95)	(0.95)	(2.96)	(1.00)
Urban population (% pop)	-0.41			-0.56	-0.53	2.27***	-1.34***
	(0.31)			(0.38)	(0.34)	(0.76)	(0.37)
Service sector (% GDP)	1.94***			1.14**	1.14**	-2.15**	2.56***
	(0.42)			(0.51)	(0.50)	(1.01)	(0.54)
FDI (% GDP)	0.08			0.40**	0.40**	0.08	0.77***
	(0.17)			(0.17)	(0.17)	(0.44)	(0.19)
ln(Fixed internet speed)		0.46***		0.46***	0.47***	1.17***	0.37**
		(0.13)		(0.12)	(0.13)	(0.20)	(0.15)
ln(Mobile internet speed)		0.31***		0.29***	0.30***	0.71***	0.46***
		(0.10)		(0.09)	(0.10)	(0.21)	(0.13)
4G users (% pop)		0.55***		0.65***	0.66***	1.74***	0.54**
		(0.16)		(0.17)	(0.17)	(0.36)	(0.22)
English proficiency (0-1)			1.24***	1.14***	1.18***	1.59***	1.25***
			(0.17)	(0.17)	(0.18)	(0.40)	(0.19)
Literacy rate (%)			2.03***	1.46***	1.53***	0.65	1.78***
			(0.49)	(0.41)	(0.48)	(0.76)	(0.63)
College graduates (% pop)			0.03*	0.05***	0.05***	0.18***	0.05**
			(0.02)	(0.02)	(0.02)	(0.06)	(0.02)
White-collar and sales jobs (% empl.)			0.88	1.23*	1.37	-1.03	1.18
			(0.92)	(0.72)	(0.99)	(1.56)	(0.93)
Quarterly FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	670	670	670	670	670	670	670
Adjusted R-squared	0.456	0.500	0.476	0.543	0.542	0.347	0.530

Note: Robust standard errors are in parentheses. All independent variables measured in percentage points are divided by 100. Missing values are imputed with predictions from the corresponding auxiliary cross-country regression on ln(GDP per capita), ln(Population) and regional dummies. The data covers 2023Q2 – 2024Q1. Countries with limited access to ChatGPT are excluded, including China. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

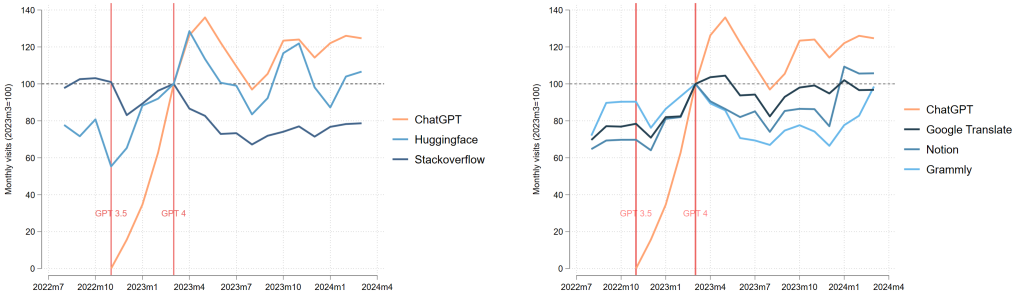
Drivers of GenAI Adoption (cont.)

Dependent variable	ln(Quarterly traffic per internet user)			
	Chatbot	Image	Video	Search engine
	(1)	(2)	(3)	(4)
ln(Quarterly GDP per capita)	-0.04	0.01	-0.12	0.22***
	(0.10)	(0.14)	(0.16)	(0.06)
20-34 age group share (% pop)	5.28***	5.30***	3.54*	0.42
	(0.93)	(1.68)	(2.11)	(0.89)
Urban population (% pop)	-0.54	0.09	0.33	-0.11
	(0.34)	(0.47)	(0.56)	(0.19)
ln(Fixed internet speed)	0.46***	0.67***	0.68***	0.35***
	(0.13)	(0.16)	(0.16)	(0.06)
ln(Mobile internet speed)	0.29***	0.35**	0.51***	0.08
	(0.09)	(0.17)	(0.16)	(0.06)
4G users (% pop)	0.65***	1.20***	1.84***	0.90***
	(0.16)	(0.24)	(0.29)	(0.13)
Service sector (% GDP)	0.96*	0.63	0.95	1.30***
	(0.50)	(0.65)	(0.90)	(0.34)
FDI (% GDP)	0.45***	0.78***	0.67*	0.49***
	(0.17)	(0.28)	(0.35)	(0.17)
English proficiency (0-1)	1.15***	0.76***	1.10***	0.93***
	(0.17)	(0.25)	(0.33)	(0.16)
Literacy rate (%)	1.69***	3.72***	2.27***	2.16***
	(0.47)	(0.82)	(0.88)	(0.30)
College graduates (% pop)	0.05***	0.06	0.10	0.06*
	(0.02)	(0.07)	(0.09)	(0.04)
White-collar and sales jobs (% empl.)	1.42	-0.47	-0.66	0.19
	(0.99)	(1.02)	(1.12)	(0.44)
Quarterly FE	Yes	Yes	Yes	Yes
Observations	670	670	670	670
Adjusted R-squared	0.545	0.554	0.490	0.811

Note: Robust standard errors are in parentheses. All independent variables measured in percentage points are divided by 100. Missing values are imputed with predictions from the corresponding auxiliary cross-country regression on ln(GDP per capita), ln(Population) and regional dummies. The data covers 2023Q2 – 2024Q1. Countries with limited access to ChatGPT are excluded, including China. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Who's Using GenAI?: Signs of Platform Substitution

- Following the release of GPT-4, traffic to traditional information and writing platforms—such as Stack Overflow and Grammarly—declined notably
- Suggests that users are substituting GenAI tools for coding help and language tasks



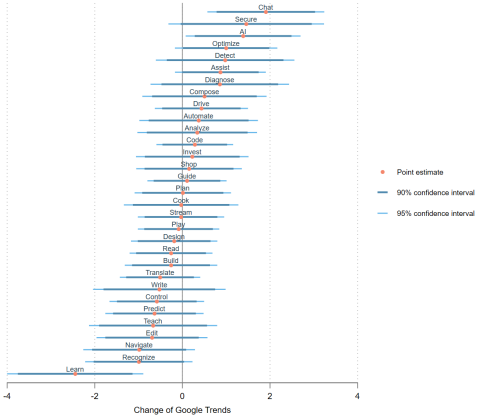
Traffic trends for coding and writing-related websites post-GPT-4

- We examine how ChatGPT adoption correlates with shifts in online search behavior using country-level panel regressions.
- We first ask ChatGPT to suggest 30 verbs most likely impacted by GenAI usage.
- For each keyword, we estimate:

$$\text{GoogleTrend}_{it}^{(\text{keyword}_k)} = \alpha \ln(\text{ChatGPT}_{it-1}) + \beta X_{it} + \delta_t + \theta_i + u_{it}.$$

  - i indexes countries; t is for month
  - δ_t and θ_i control for two-way FE
  - X_{it} include Google traffic (log) and country-specific linear trend

- The keyword "learn" shows a negative association with ChatGPT usage, implying that a core segment of GenAI users relies on it for learning tasks.



ChatGPT impact on Google Trends for keywords

Conclusion & Policy Implications

- This paper attempts to use website traffic and search behavior data to identify the profile of GenAI users across demographic, geographic, and usage dimensions.
- Five key takeaways:
  1. GenAI adoption has surged, with ChatGPT as the dominant platform
  2. Users skew younger, male, and more educated
  3. Middle-income countries outperform expectations, accounting for half of global traffic
  4. Adoption is driven by digital infrastructure, service sector orientation, and human capital
  5. GenAI is disrupting traditional information platforms and online behaviors
- **Looking Ahead:**
  - Improve real-time tracking of GenAI uptake—especially in developing countries—through surveys, web analytics, and other innovative data sources.
  - A natural next step is to examine GenAI's impacts on productivity, employment, and industry structure—especially in low- and middle-income countries.
  - Policy implications for low- and middle-income countries:
  1. Foster GenAI adoption by investing in digital infrastructure and closing skill gaps.
  2. Mitigate potential risks by preparing for the disruptive effects of AI on employment and global economic specialization.

Thank You!

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