Competition and Defaults in Online Search

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Regulating Digital Markets

- Influential policy reports have argued for new regulations in digital markets and several countries have already enacted them.
- Nevertheless, there is scarce evidence on whether such an approach might work and on what behaviors these regulations should forbid or promote.
- To understand the effects of regulation, need to think about two dimensions:
  1. Is the market is a natural monopoly?
  2. Are the agents connected by the platforms rational players?

$\rightarrow$ If the market is a natural monopoly and the agents are rational, IO literature offers insights on how an optimal regulation should be designed.

$\rightarrow$ If the market is not natural monopoly, regulatory intervention might aim at bolstering competition and optimal regulation will depend on whether the platform's users are rational or have behavioral biases.

The Role of Defaults in Mobile Search

- If users are rational, they cluster on Google due to the superior quality of its service, which benefits from within-group network effect:
  - → Data sharing mandates would allow alternative search engines to improve their quality, strengthening competition.
- Now suppose that there is no quality advantage of Google relative to its rivals. Consumers - due to a default effect - use whatever search engine they find pre-installed on their device:
  - → Regulation mandating that Google shares its data with the other search engines is completely ineffective in fostering competition in search.
  - → Regulatory intervention would need to account for users' behavioral biases.

Research Question and Contribution

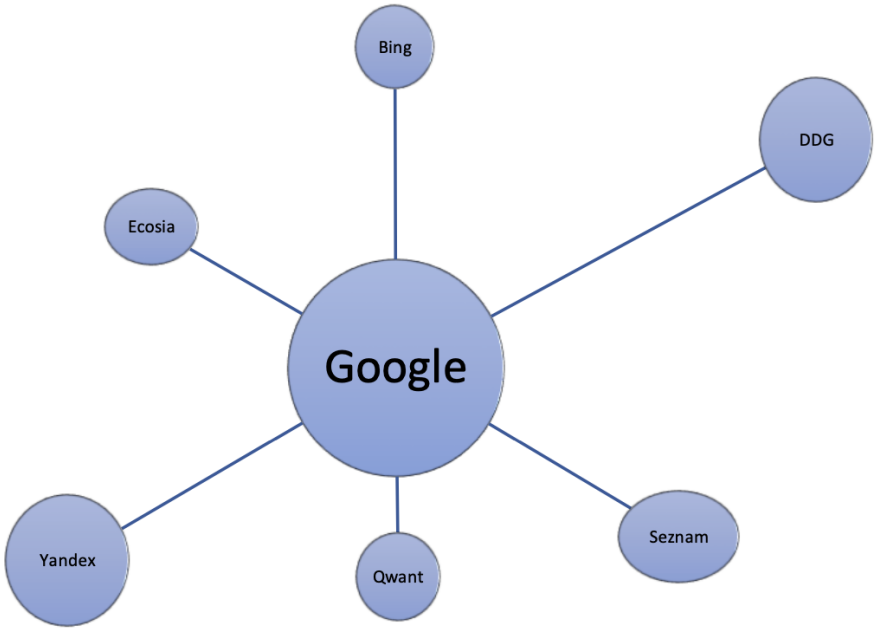
- We empirically analyse the effect of three different policy interventions that tackled Google's position as the default search engine on Android devices. The policies we study were implemented by:
  1. European Economic Area (EEA) countries
  2. Russia
  3. Turkey
- We find that these intervention induced a causal drop in Google market share in mobile search, but with important differences due to the policy design (i.e., *antitrust remedy design*).

Related Literature

1. Behavioural biases and the role of defaults:
   - Role of defaults: Thaler and Sunstein (2008) and Jachimowicz et al. (2019).
   - Effect on consumer choices: Ericson (2020) and the references therein.
2. Market design:
   - Market design in traditional auction and matching markets: Roth (2015); Ausubel et al. (2006); Levin and Skrzypacz (2016); Chassang and Ortner (2019); Agarwal (2017).
   - Market design in online auction markets: Varian (2007); Varian and Harris (2014); Börgers et al. (2013); Che et al. (2017); Einav et al. (2018); Coey et al. (2020); Backus et al. (2020); Decarolis et al. (2020).
   - Market Design and behavioural IO: Coey et al. (2020); Grubb, 2015.
3. Choice screen antitrust intervention:
   - Law and Economics literature on the Microsoft EEA choice Screen: Economides and Lianos (2010); Vásquez Duque (2021).
   - Theoretical analysis of the auction design in the initial implementation of the Google EEA choice screen: Ostrovsky (2020).

Outline

Basic Model



- Two types of users:
  - ✓ captive users: $1 - N$
  - ✓ shoppers: N
- A shopper is placed on the link between Google and a specific search engine when this search engine is in the shopper's consideration set (search engines among which to choose).
- Shopper problem:
  1. given a consideration set,
  2. given preferences and awareness of search engines,
  3. choose the optimal search engine in the consideration set.
- Equilibrium analysis details

Implications from the Model

- Shoppers demand for Google vs rival search engines:
  - ✓ The market share of Google decreases in the percentage of shoppers, while the market share of competing company increases.
  - ✓ There exists a quality cutoff such that competing search engines with low quality gain no market share, even shown to shoppers.
  - ✓ Given a rival search engine's quality is sufficiently high, its market share increases in both its relative service quality and its relative awareness.
- Thus, policy interventions to bolster competition in search might target:
  - ✓ Share of shoppers.
  - ✓ Consideration set: measure and composition of competitors in this set.
  - ✓ Relative characteristics of the options: service quality and market awareness.
- Multiple possible interventions, and some with ambiguous effects.

Outline

The Market for Mobile Search

- Consumers search the web though various access points on their mobile and desktop devices.
- The search engine that is initially associated with these access points on devices sold to consumers is the "default" search engine.
  - Google was the default search engine for over 99% of the mobile browser searches in the UK in February 2020 (CMA, 2020).
- Search engines differentiate themselves among many dimensions:
  - Privacy protection: DuckDuckGo.
  - Support for social causes: Ecosia and Panda Search
  - Country of origin and global presence:
    - Google, Bing, DuckDuckGo are global players, founded in the US.
    - Yandex is a Russian search engine available globally.
    - Seznam.cz (from Czechia) and Qwant (from France) are smaller search engines that serve fewer countries.

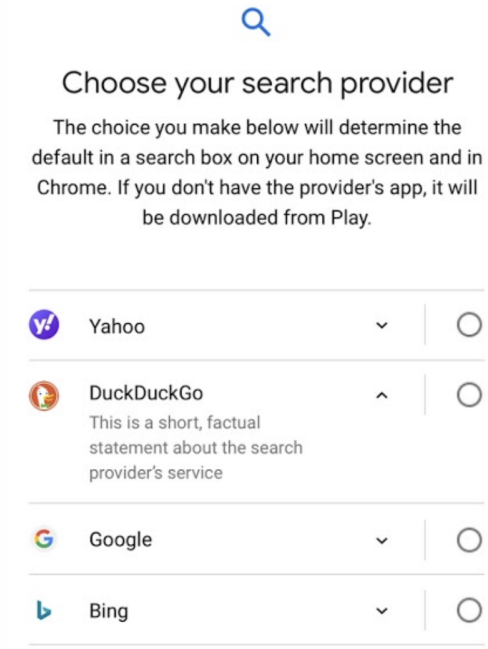
European Intervention

- In July 2017, the European Commission (EC) fined Google €4.34 billions for bundling its Play Store, Google Search app, and Google Chrome browser (Google Mobile Services) to mobile manufacturers in the EEA.
- EC and Google agreed to implement a choice screen for general search providers on all new Android phones. During the device setup, new Android users can choose between Google and competing search engines. Criteria determininng which search engines are shown evolved over time:
  1. *Pay-to-Play* choice screen: competing search providers participated in an auction, conducted quarterly and separately for each EEA member state.
     → Criticized by competitor search engines and by Ostrovsky (2020).
  2. *Free-to-Play* choice screen: free participation for competing search engine, with the top five search engines selected based on market shares.

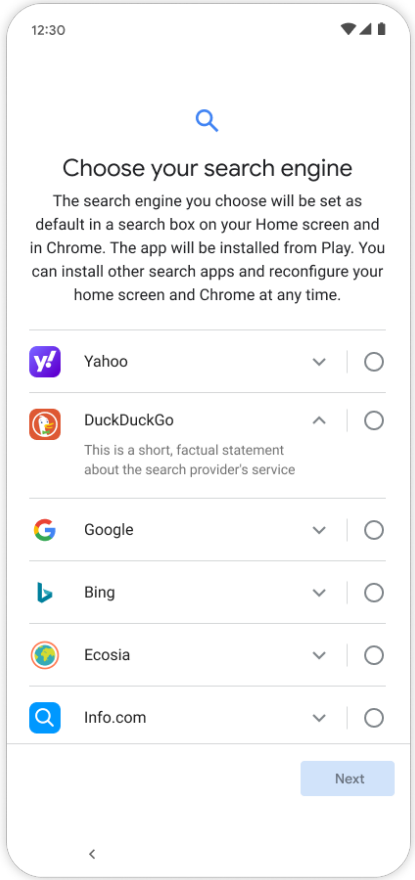
Russian Intervention

- In April 2017, Russia's Federal Antimonopoly Service (FAS) agency fined Google 438 million roubles ($6.5 million USD) for violating the antimonopoly legislation. The abuse revolved around Google prohibiting the pre-installation of other developers' competing mobile applications.
- Following the FAS decision, a choice screen allowing users to select their search engine was implemented in Russia.
- Important distinctive features of the Russian choice screen:
  1. The choice screen was accessible for all Android mobile devices in the country, not just for new devices.
  2. The list of search engines appearing on choice screen was fixed, only Yandex and Mail.ru appeared throughout.

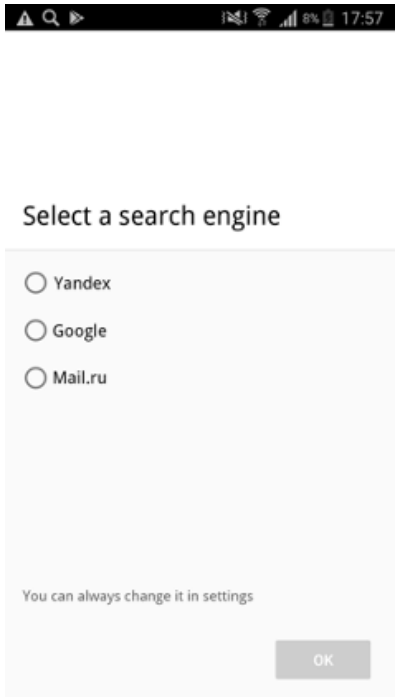
Choice Screen Comparison



(a) EEA Pay-to-Play



(b) EEA Free-to-Play



(c) Russian Choice Screen

Turkish Intervention

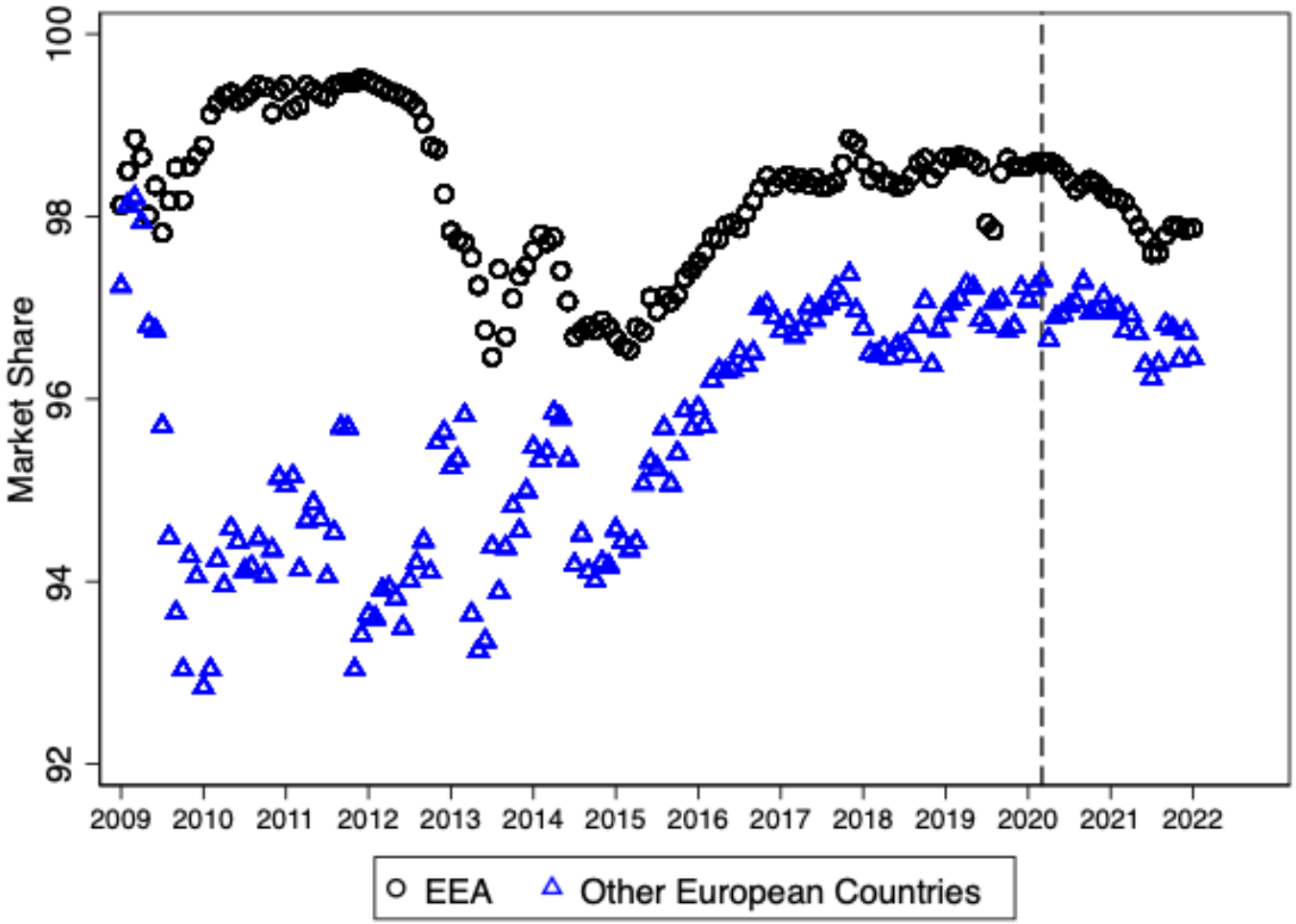
- Following a complaint from Yandex, in Semptember 2018 the TCA concluded that Google held a dominant position in the market for licensable mobile operating systems and its agreements with mobile manufacturers constituted abusive behavior.
- Remedies were designed with the goal to allow original equipment manufacturers ("OEMs") to be free to set competing search engines in the device's search access points.
- The TCA mandated Google alter its contracts with OEMs to remove any provision providing Google a privileged access to the device's search access points.
  - Remedies similar to the ones of the EC, but with additional requirement to remove revenue sharing agreements from Android licensing contracts.
  - No choice screen to select alternative search engines was ever implemented.
  - Following the harsh stance from the TCA, reports circulated indicating Google would no longer licence Android OS to device manufacturers in Turkey.

Outline

Data Description

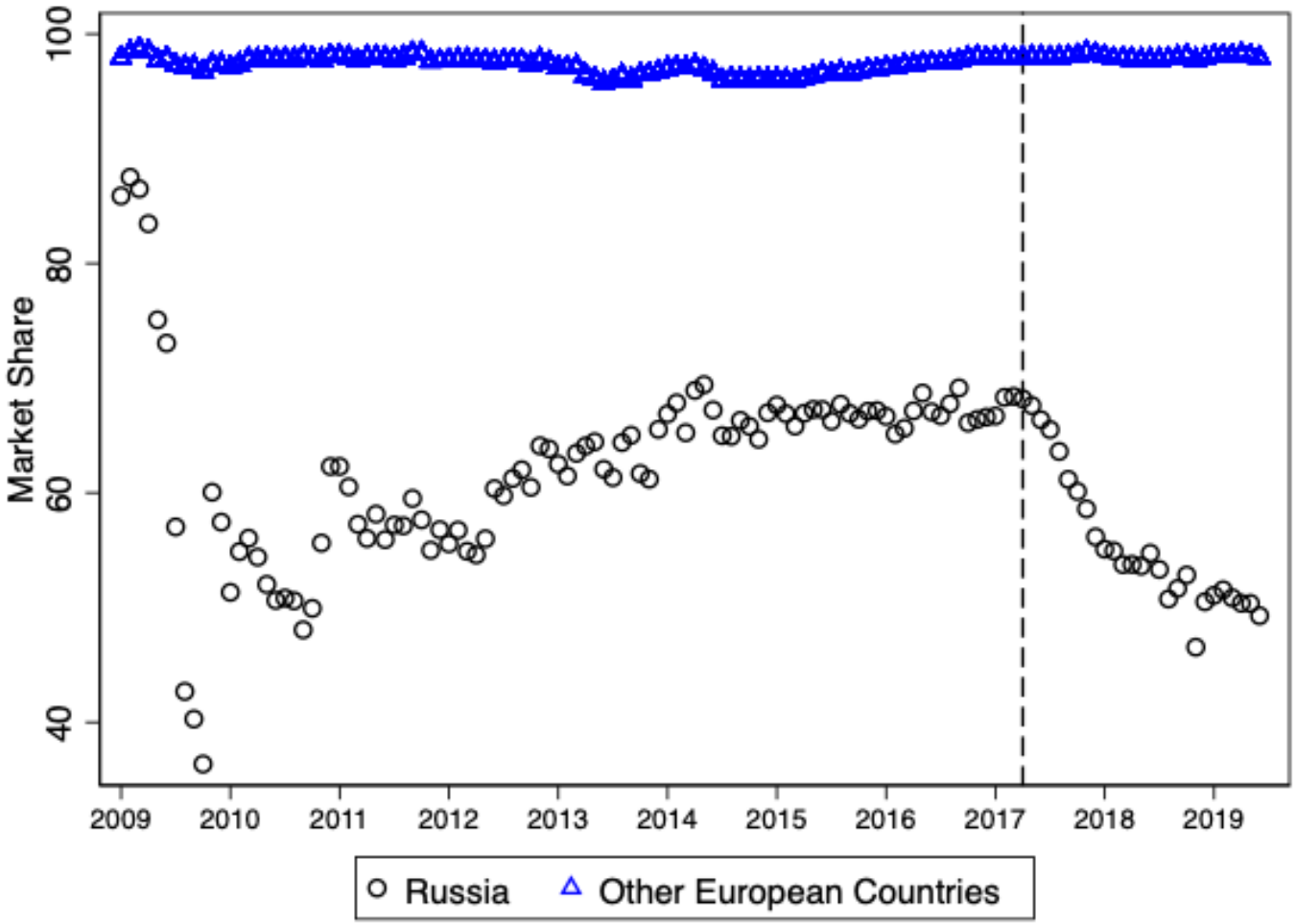
1. Market Share Data: StatCounter
   - Records more than 10 billion page views from over 2 million websites.
   - Monthly market shares for all search engines over 238 countries from 2009.
2. Device Shipments Data: Gartner
   - Quarterly phone shipments for the largest 50 countries from 2016.
3. App Downloads Data: Apptweak
   - Daily downloads from the Google Play Store and Apple App Store from September 2015 for 26 search apps over 40 countries.
4. Search Advertising Data: SEMrush
   - Keyword-level search advertising data, from 2017 annd for over 40 countries.

Google Market Share Trends (EEA)



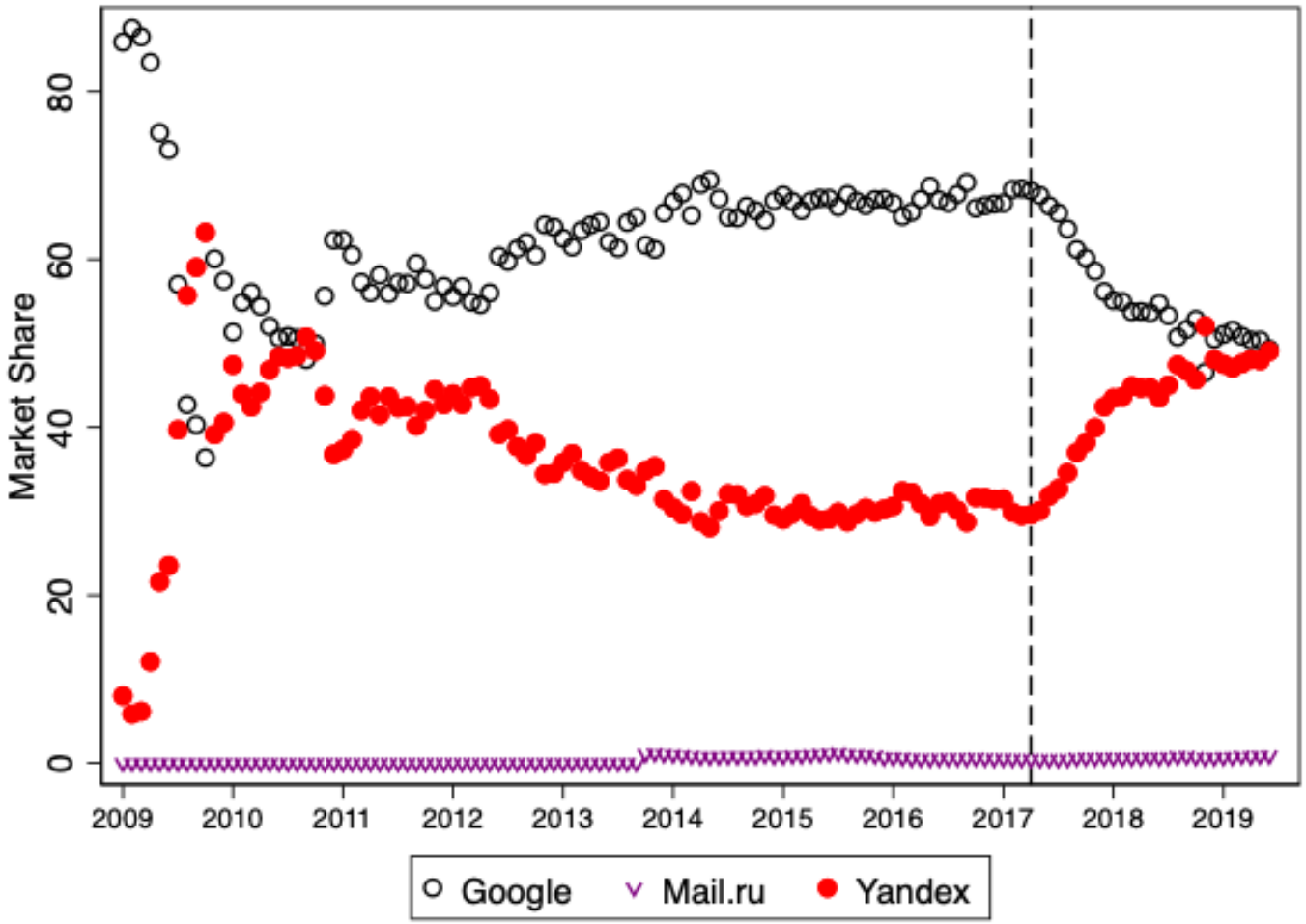
Notes: The vertical line corresponds to the introduction of the choice screen.

Google Market Share Trends (Russia)



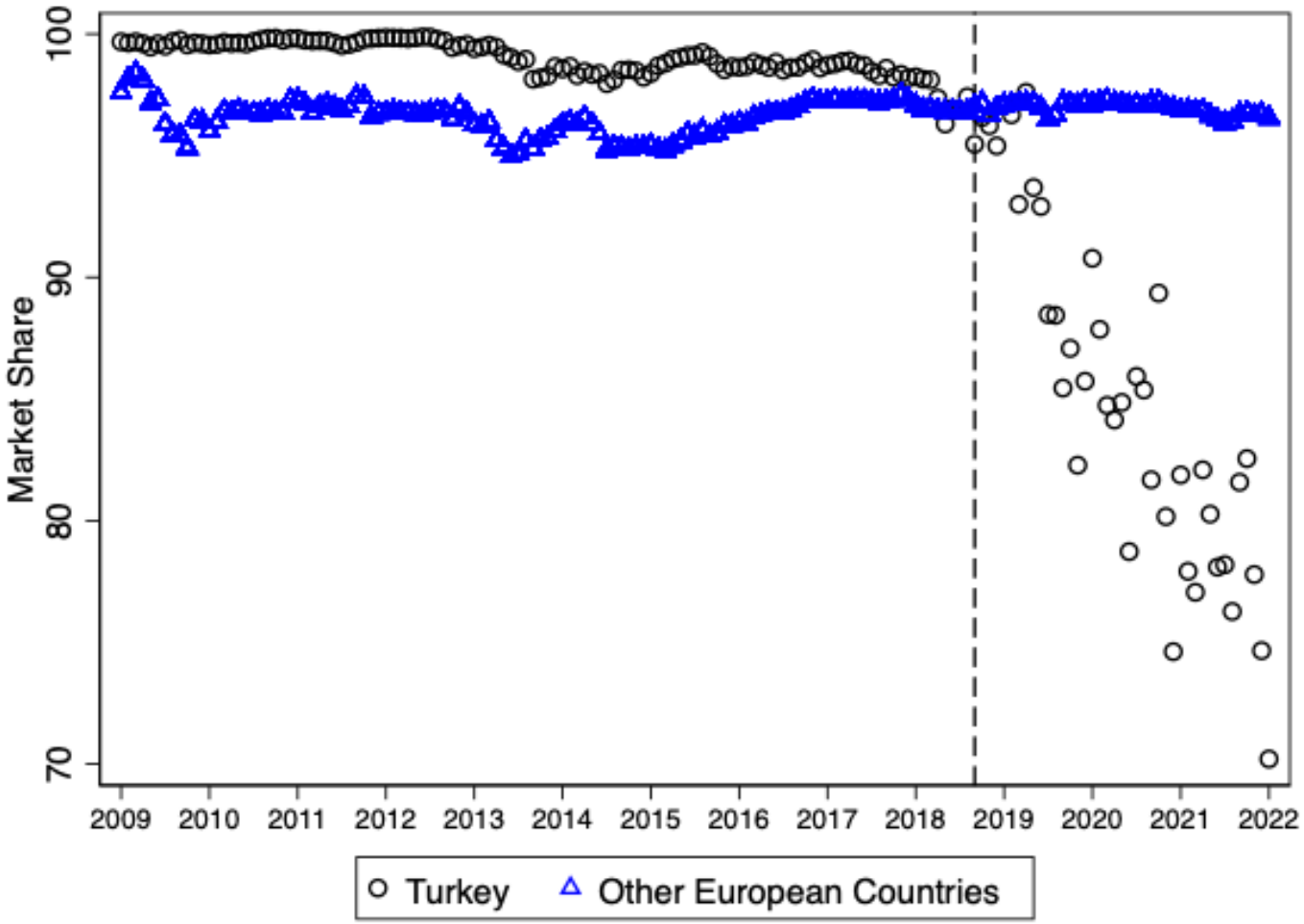
Notes: The vertical line corresponds to the introduction of the choice screen.

Search Engine Market Share Trends (Russia)



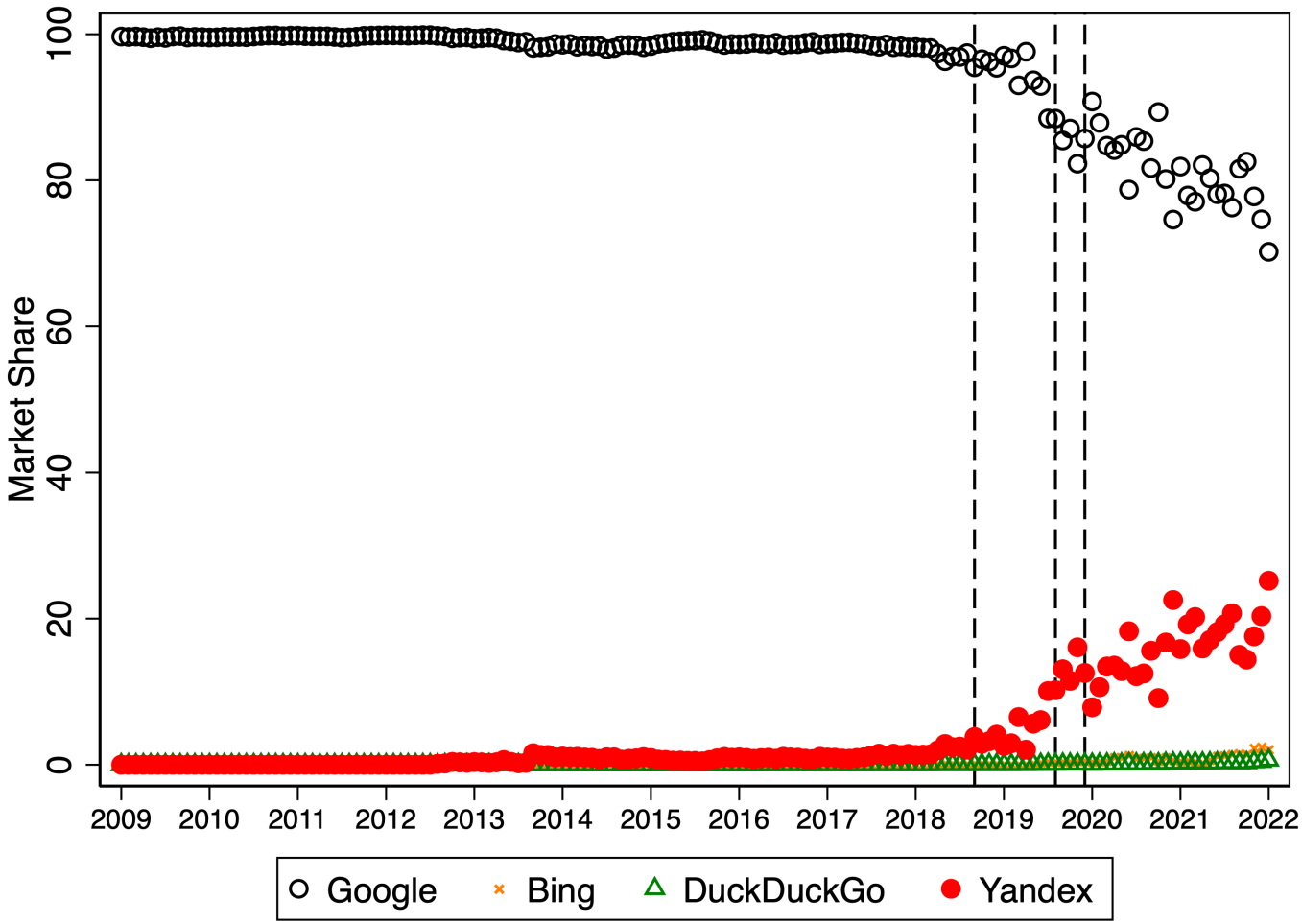
Notes: The vertical line corresponds to the introduction of the choice screen.

Google Market Share Trends (Turkey)



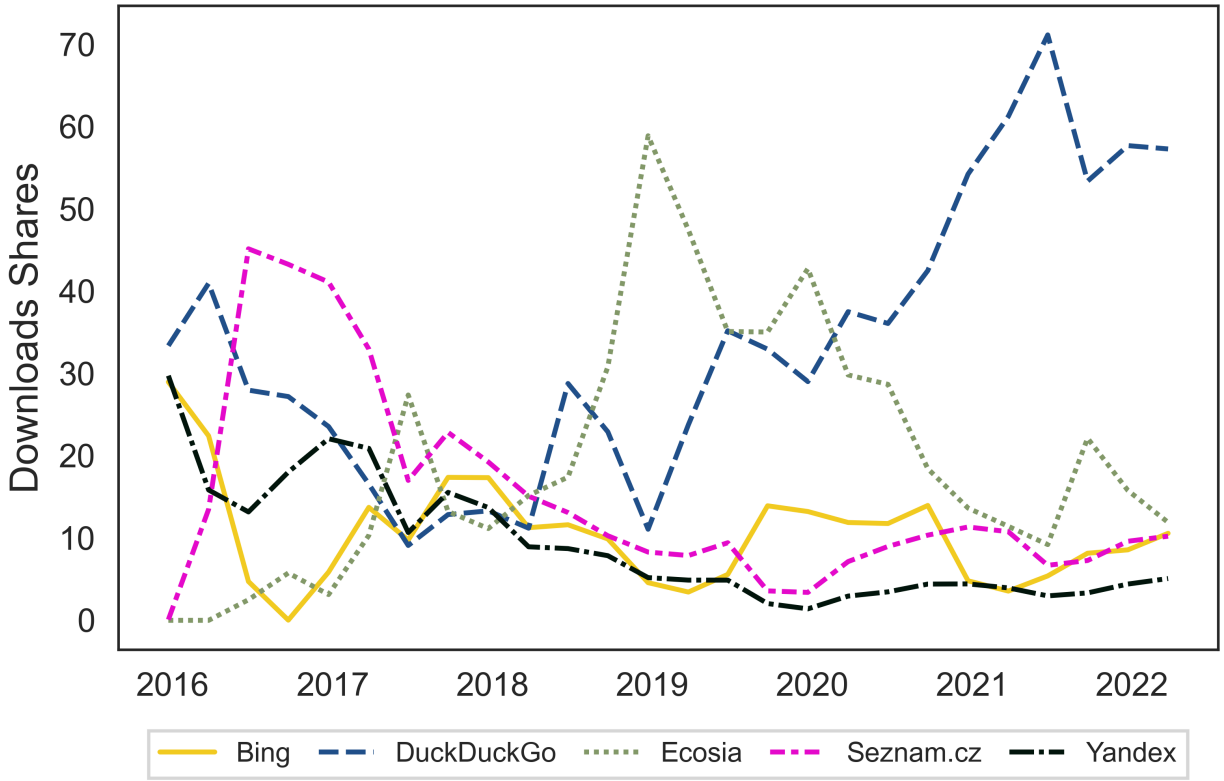
Notes: The vertical lines corresponds to the TCA decision

Search Engine Market Share Trends (Turkey)



Notes: The vertical lines corresponds to the TCA decision

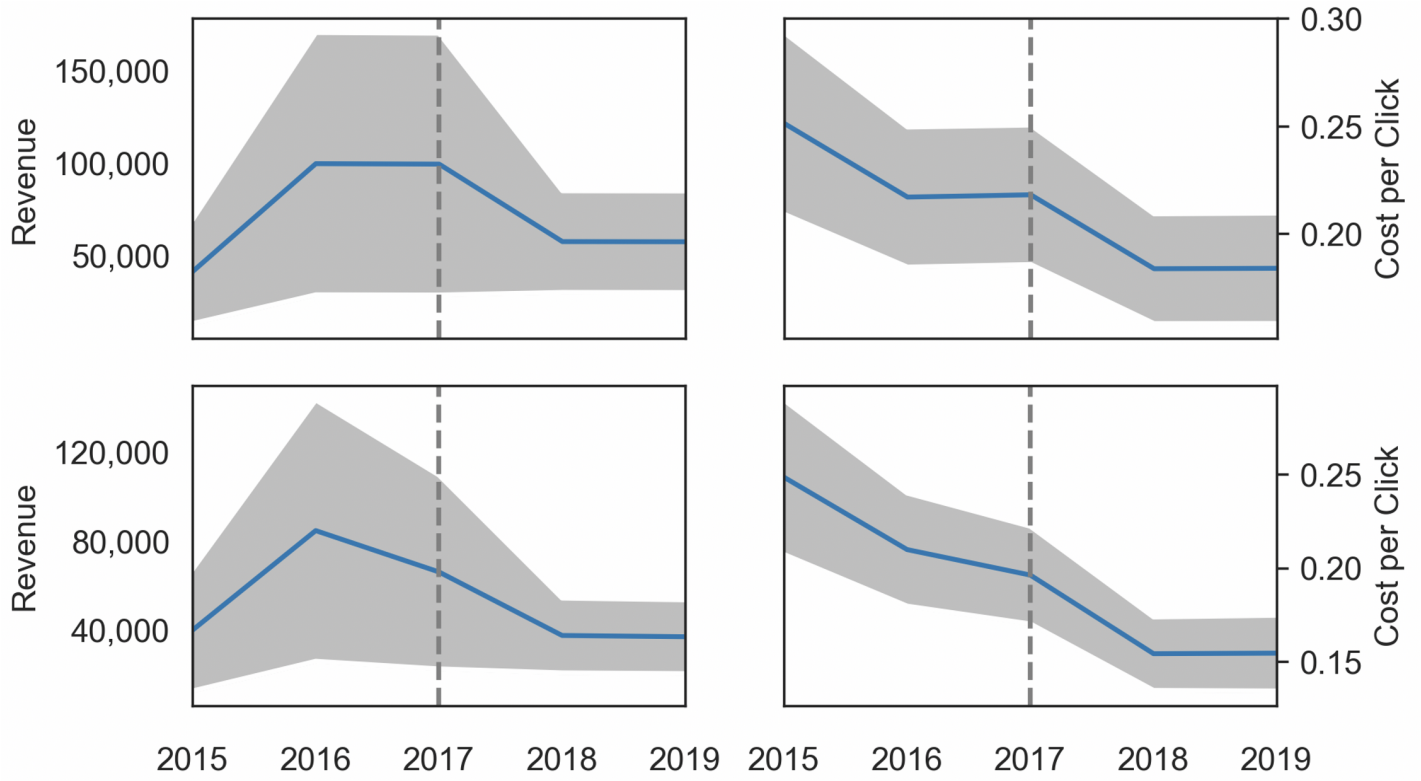
Ancillary Data: Competitor Download Share Trends (EEA)



Notes: Play Store downloads from Apptweak aggregated at quarterly level. Downloads are aggregated for the 30 EEA countries. Apps considered in the market are all search engine apps other than Google. The plot shows the top 5 most downloaded apps over the period.

Ancillary Data: Advertiser Response on Google Paid Search

Figure: Platform Revenues and CPC for Top Keywords: mobile paid search - Russia



Note: SEMrush data. Top overlapping keywords among English speaking countries in 2007. Top panels: 5,574 different keywords, part of paid search for at least one year; bottom panels: 2,860 keywords, part of paid search in all years.

Outline

EEA Remedy: Binary DiD

We employ a difference-in-differences identification strategy to estimate the effect of the EEA remedy on Google mobile market shares. We first estimate the binary treatment model:

$$Google_{ct} = \alpha + \beta did_{ct} + \lambda_c + \gamma_t + \varepsilon_{ct} \tag{1}$$

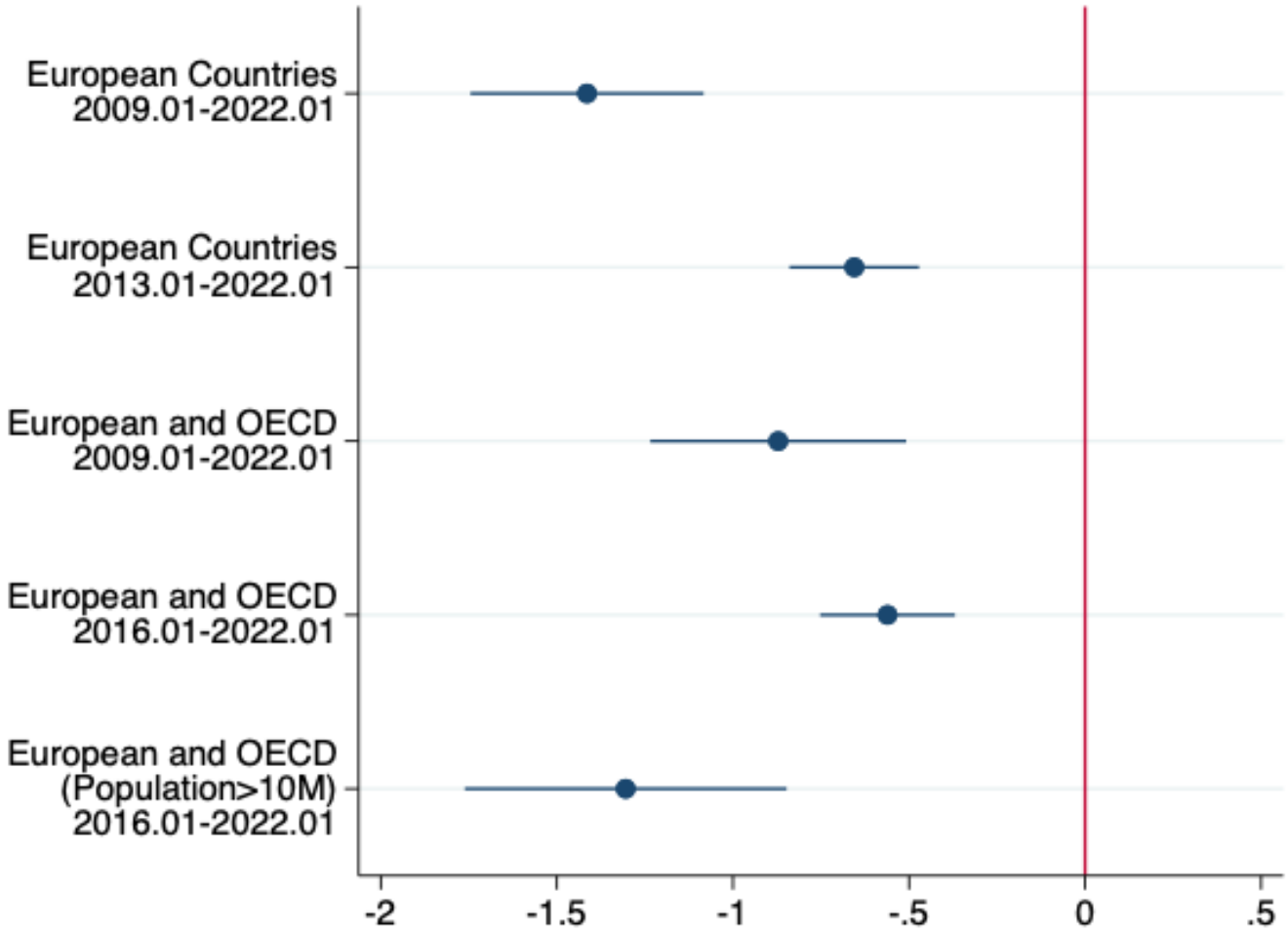
- $Google_{ct}$: Google's market share in country c and month t
- λ_c: country fixed effect, γ_t: month fixed effect
- did_{ct}: indicator that turns on for treated countries after the policy is implemented (March 2020)

Assumptions required for identification:

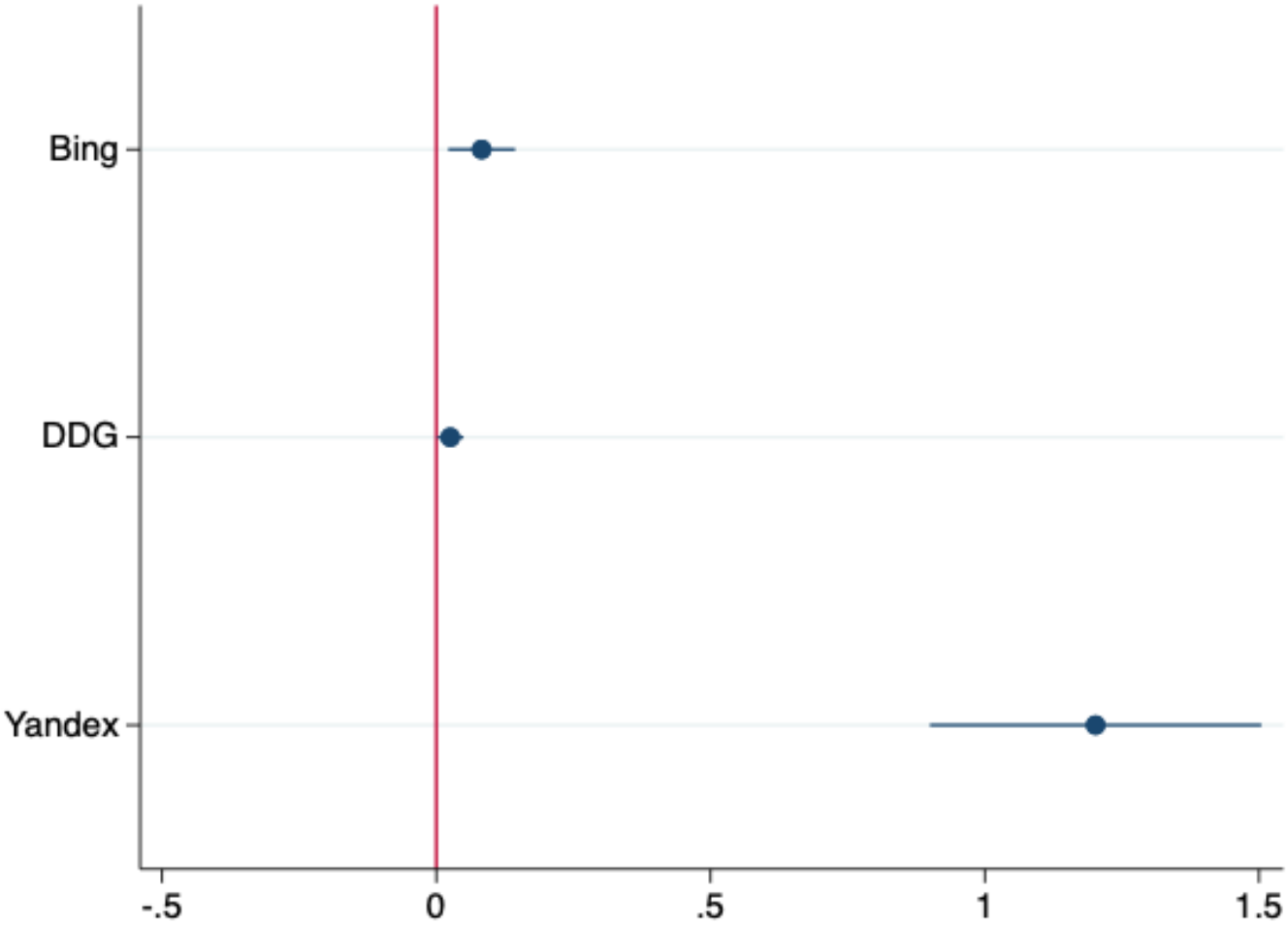
- Common trends
- Homogeneous and static treatment effect
  - $\rightarrow$ In the Appendix, we relax this assumption, employing modern identification strategies developed in De Chaisemartin and D'Haultfoeuille (2020).

EEA Remedy: Binary DiD Estimates

Figure: Impact of EEA remedy on Google with Alternative Samples



EEA Remedy: Effect on Competing Search Engines



Notes: Treatment effect estimates (and 95% CI) from binary DiD models as equation (1), the dependent variable is the corresponding competing search engine market share.

EEA Remedy: Weighted DiD

We also analyze how the number of new android phones in a given country influences the effectiveness of remedy, estimating the following weighted difference-in-differences model:

$$Google_{ct} = \alpha + \beta(did_{ct} \times ship_{cq(t)}) + \psi ship_{cq(t)} + \gamma_c + \lambda_t + \varepsilon_{ct} \quad (2)$$

- $ship_{cq(t)}$: fraction of Android shipments over total phone shipments in country c and quarter q corresponding to period t

Under some assumptions on the data generating process, the two models identify distinct policy relevant effects:

- $\hat{\beta}_{\text{binary}}$ = remedy effect on overall mobile search ($\sim ATE$)
- $\hat{\beta}_{\text{ship}}$ = remedy effect on Android mobile search ($\sim ATT$)

EEA Remedy: Weighted DiD Estimates

VARIABLES	(1) Google	(2) Google	(3) Google	(4) Google
did* % android in shipment		-0.93***		-1.32***
		(0.26)		(0.37)
% android in shipment		-1.21		-1.71
		(0.86)		(1.42)
did	-0.73***		-1.10***	
	(0.19)		(0.28)	
Observations	1,863	1,863	1,206	1,206
R-squared	0.94	0.94	0.94	0.94
Country FE	YES	YES	YES	YES
Month FE	YES	YES	YES	YES

Notes: The first two models include all European and OECD countries between January 2016 and January 2022, except Turkey, Russia, Czechia, and countries where shipment data is not available. The last two models further remove countries with population lower than 10 million.

Russian and Turkish Interventions

To investigate the effect of choice screen in Russia, we apply the DiD model:

$$Google_{ct} = \alpha + \beta did^R_{ct} + \lambda_c + \gamma_t + \varepsilon_{ct} \tag{3}$$

- did^R_{ct}: indicator that turns on for observations for Russia after April 2017

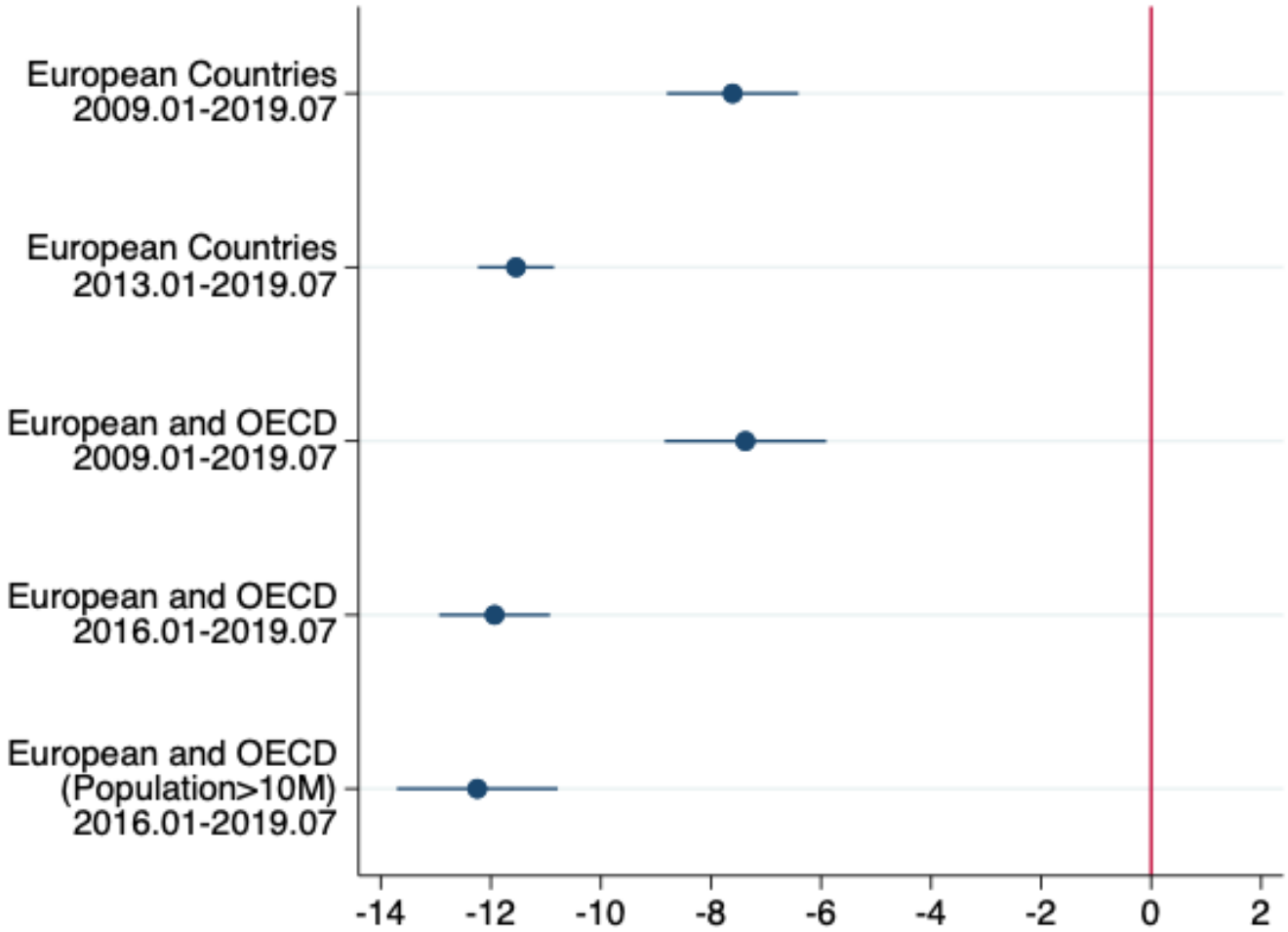
To investigate the effect of the Turkish intervention, we apply the DiD model:

$$Google_{ct} = \alpha + \beta did^T_{ct} + \lambda_c + \gamma_t + \varepsilon_{ct} \tag{4}$$

- did^T_{ct}: indicator that turns on for observations for observations for Turkey after September 2019

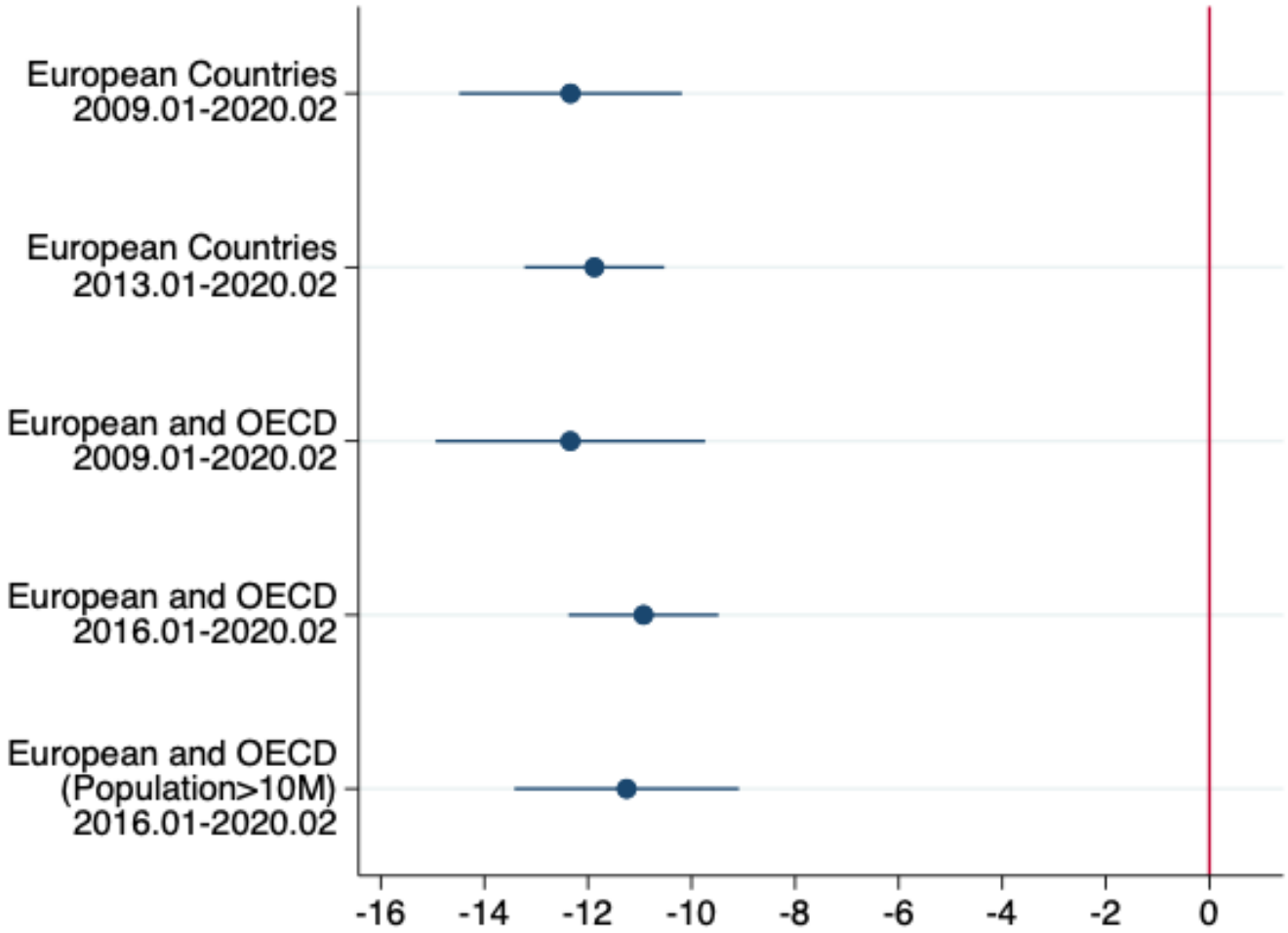
Russian Remedy Effect Estimates

Figure: Impact of Russian remedy on Google with Alternative Samples



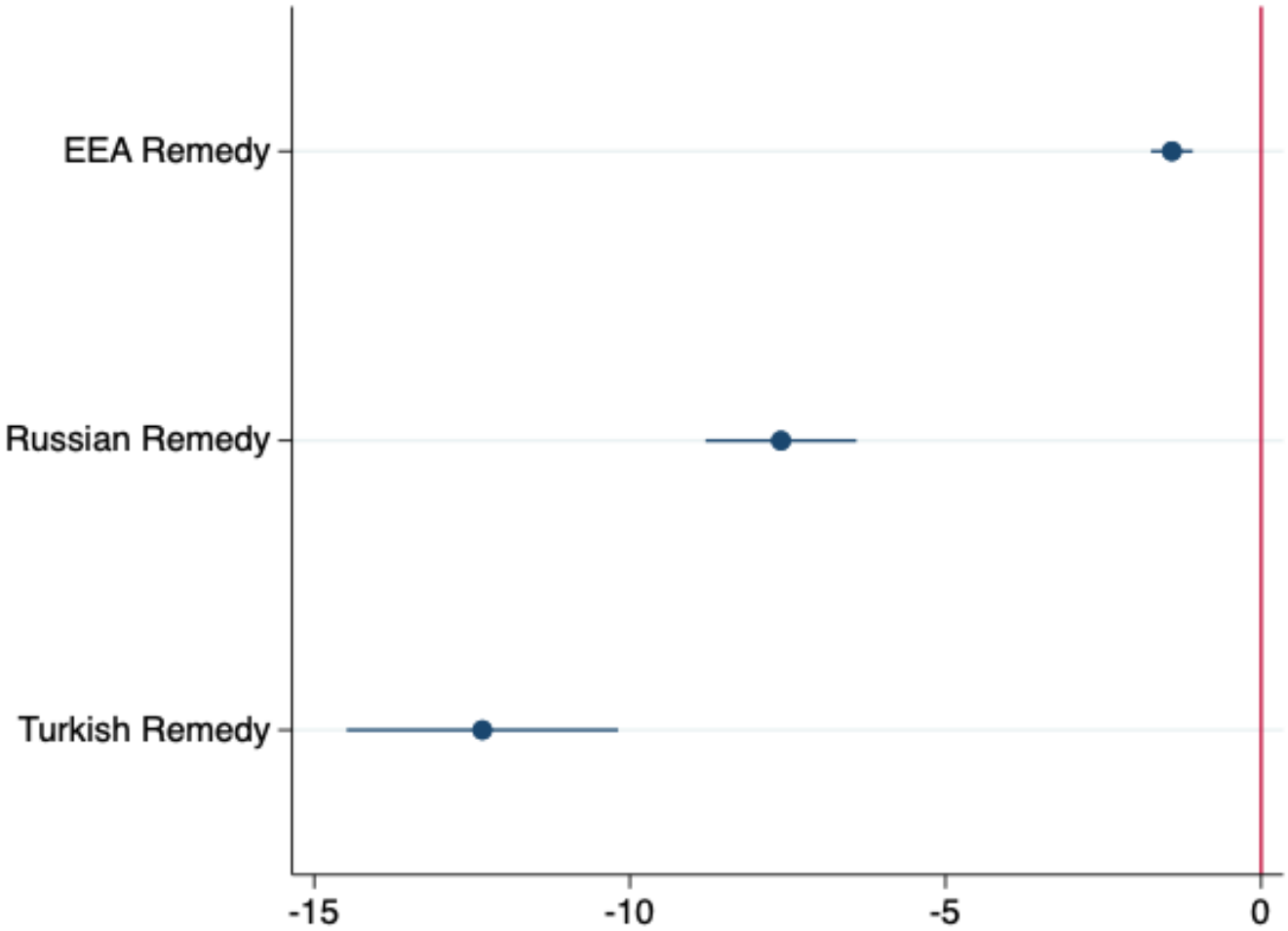
Turkish Intervention Effect Estimates

Figure: Impact of Turkish intervention on Google with Alternative Samples



Intervention Comparison: Estimates

Figure: Effects of intervention in EEA, Russia, and Turkey



Intervention Comparison: Determinants

- All interventions effectively lowered Google's market share in mobile search.
  - less than 2 percentage point decrease in the EEA;
  - more than 5 percentage point decrease in Russia;
  - more than 10 percentage point decrease in Turkey.

The three policies had very different effectiveness and design:

- Market visibility of the choice screens implemented in the EEA and in Russia are significantly different.
  - → Choice screen is accessible for all the Android mobile devices in Russia.
  - → List of search engines in the Russian choice screen is fixed.
- Pre-existing market sizes of the largest competing search engines in Russia before the intervention are much larger than that in the EEA or in Turkey.
  - → Yandex took up to almost 30% of the market share in Russia before the government implemented the choice screen.
  - → Comparative advantages due to network effects and target search accuracy.
- The Turkish remedy was able to remove incentives for device manufactures to keep Google as the default search engine on all search access points.

Evidence on the Channels

Supply (i.e., search engine) response to the remedies is crucial and, indeed, within the EEA there is a more nuanced behavior than in Ostrovsky (2020).

VARIABLES	(1) won_number	(2) won_number	(3) won_number	(4) won_number	(5) won_number	(6) won_number
Desktop Share 2020 Feb	0.08***	0.31***	0.08***	0.30***	0.11***	0.39***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)
Mobile Share 2020 Feb	1.73***	0.07	1.71***	0.06	2.13***	0.13
	(0.26)	(0.22)	(0.25)	(0.22)	(0.29)	(0.22)
Domestic Search Engine			-1.03**	0.28	-0.54	0.61
			(0.51)	(0.47)	(0.54)	(0.48)
User Information Score				0.06***		0.08***
				(0.01)		(0.01)
Accessibility & Clarity Score				-0.18***		-0.22***
				(0.02)		(0.03)
Government Demands Score				0.23***		0.26***
				(0.02)		(0.02)
Security Score				0.22***		0.27***
				(0.03)		(0.03)
Search Engine Quality			0.02***			
			(0.00)			
Observations	750	750	750	750	750	750
Pseudo R2	0.0341	0.196	0.0474	0.196	0.0446	0.210
Search Engine FE		YES				
Country Variables					YES	YES

Outline

Conclusion

One of the goals of the new Digital Markets Act is to ensure that consumers in digital markets ruled by gatekeepers "have more and better services to choose from, more opportunities to switch their provider if they wish so, direct access to services, and fairer prices". In this respect:

- Remedy design is a strong weapon of competition authorities.
- Especially true since fines are small relative to the gatekeepers cash flows.
- Competitors play a key role in the success of the remedies.

Next steps of this project:

- Using the demand equations from the model, quantify consumer welfare associated with the different policies and quantify behavioral biases
- Evaluate advertisers' response

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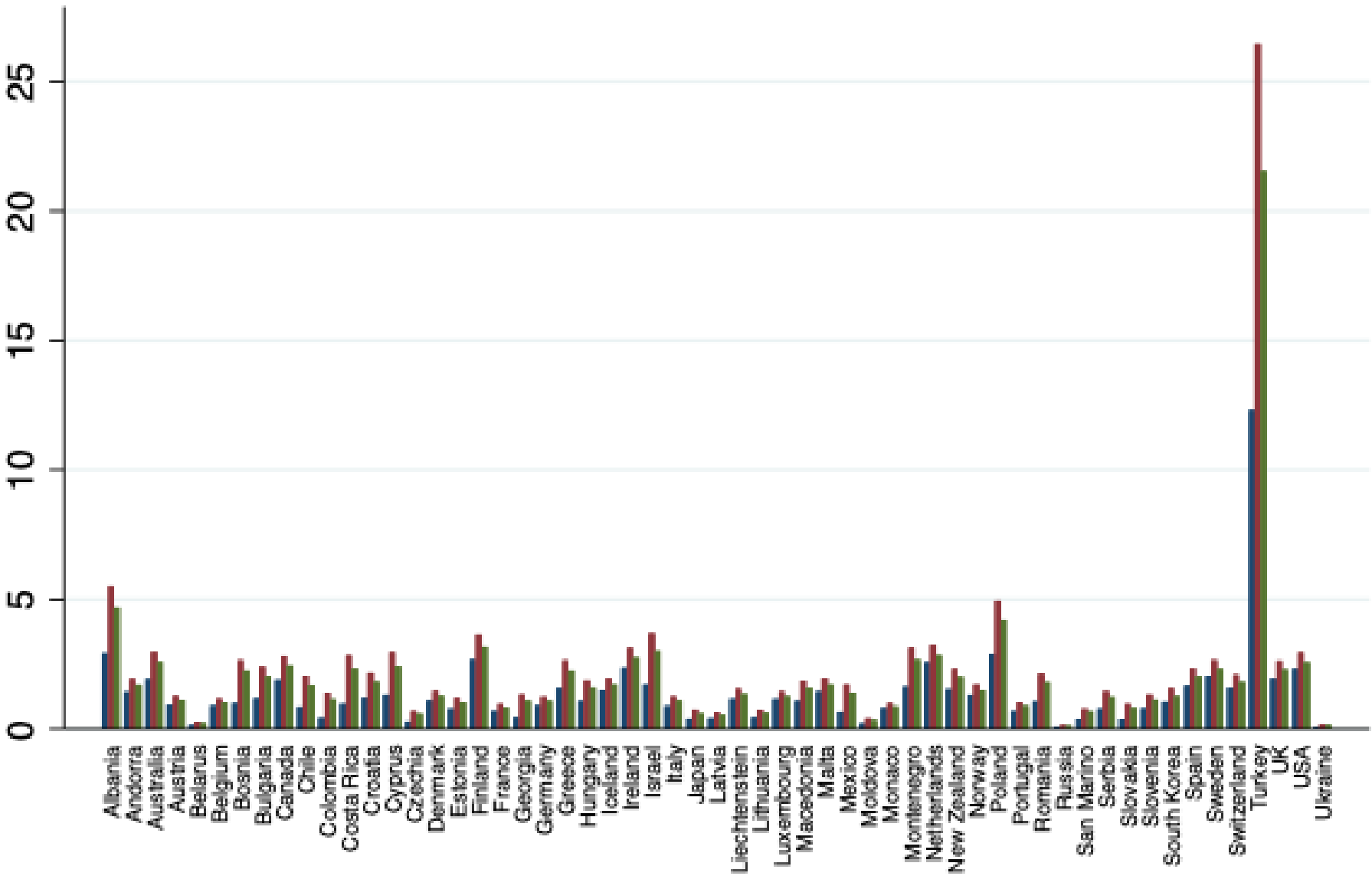
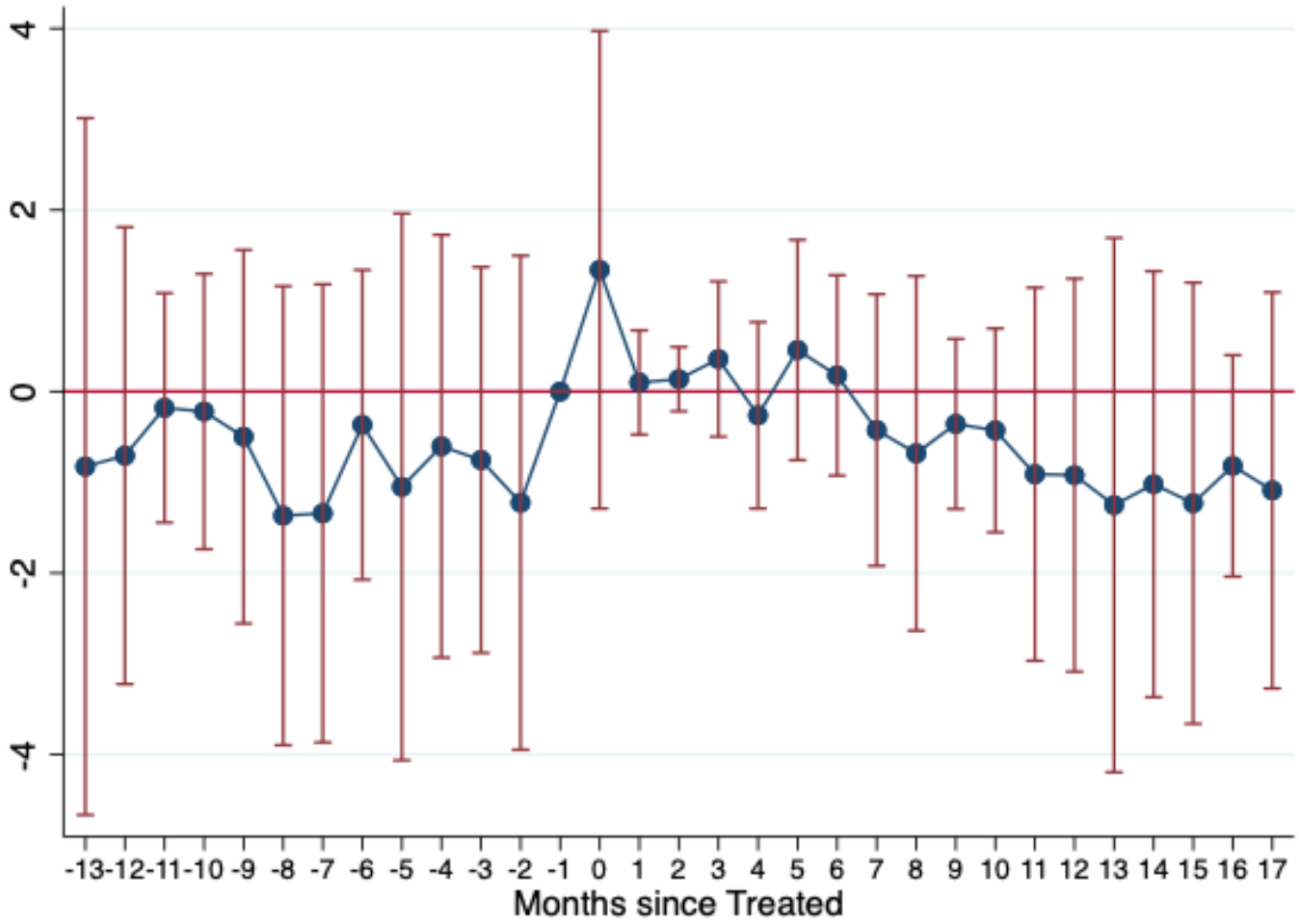
StatCounter Coverage by Country: Three Measures



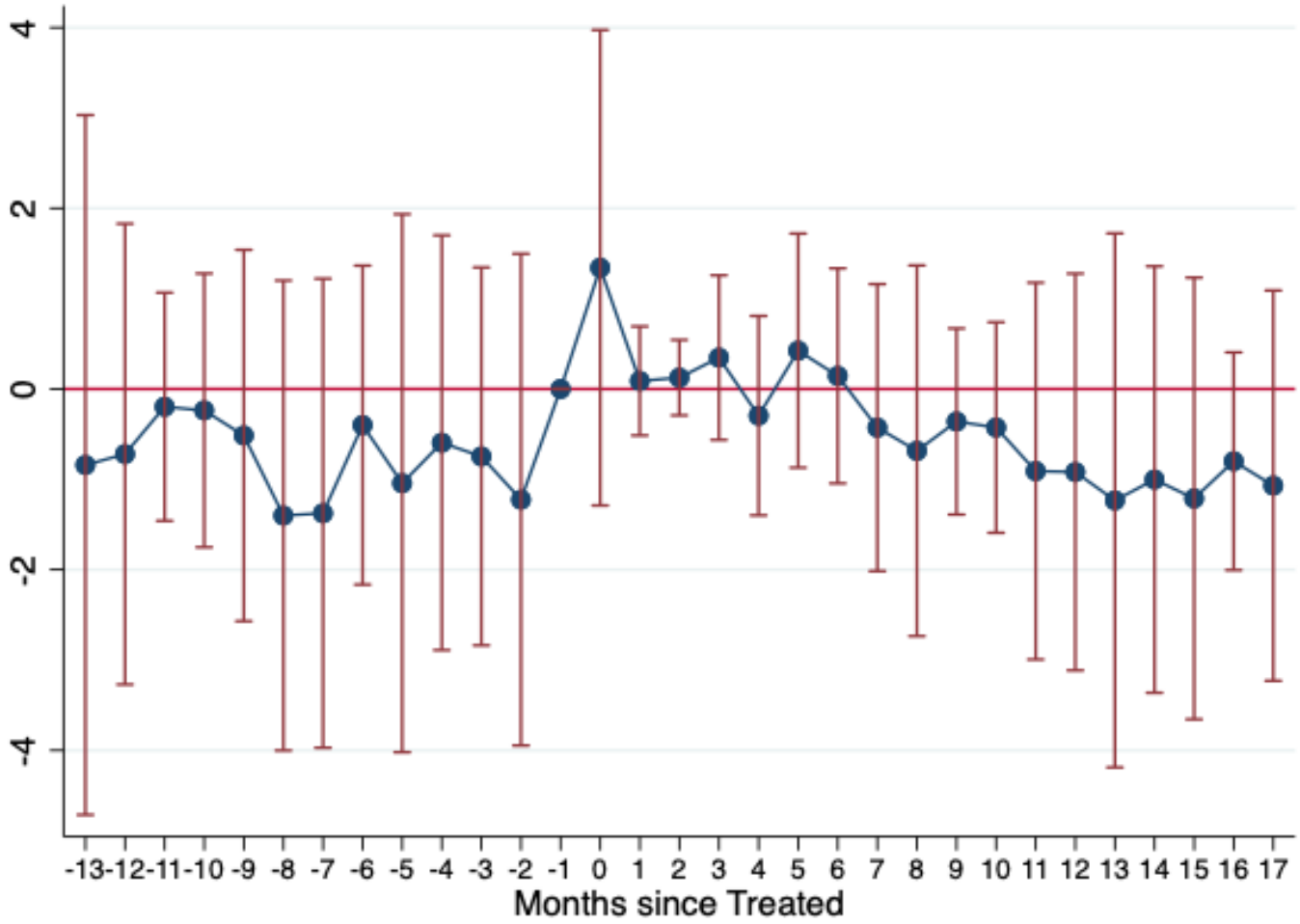
Heterogenous and Dynamic Effect of the EEA Remedy

Figure: Heterogenous and Dynamic Effect of the EEA Remedy (Binary Specification)



Heterogenous and Dynamic Effect of the EEA Remedy

Figure: Heterogenous and Dynamic Effect of the EEA Remedy (Weighted Specification)



Shopper's Game

- Consideration Set
  - ✓ Each user has only two search engines in consideration set
  - ✓ Google's always in consideration set
  - ✓ The other search engine is a competing search engine that the user is most familiar with.
  - ✓ Awareness of user i of competing company j

$$W(i,j) = w_j + \epsilon_{ij}$$

  - ✓ Probability that user i chooses search engine j into its consideration set

$$P_j = Pro\{\epsilon_{ik} < \epsilon_{ij} + w_j - w_k, \forall k \neq j\} = \frac{e^{w_j}}{\sum_k e^{w_k}}$$

- Choice of Defaulted Search Engine
  - ✓ Utility: $U(i,k) = v_k + em_k - rd(i,k)$
  - ✓ Probability of Chosen: $\frac{1}{2} + \frac{v_j - v_g + em_j - em_g}{2r}$

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