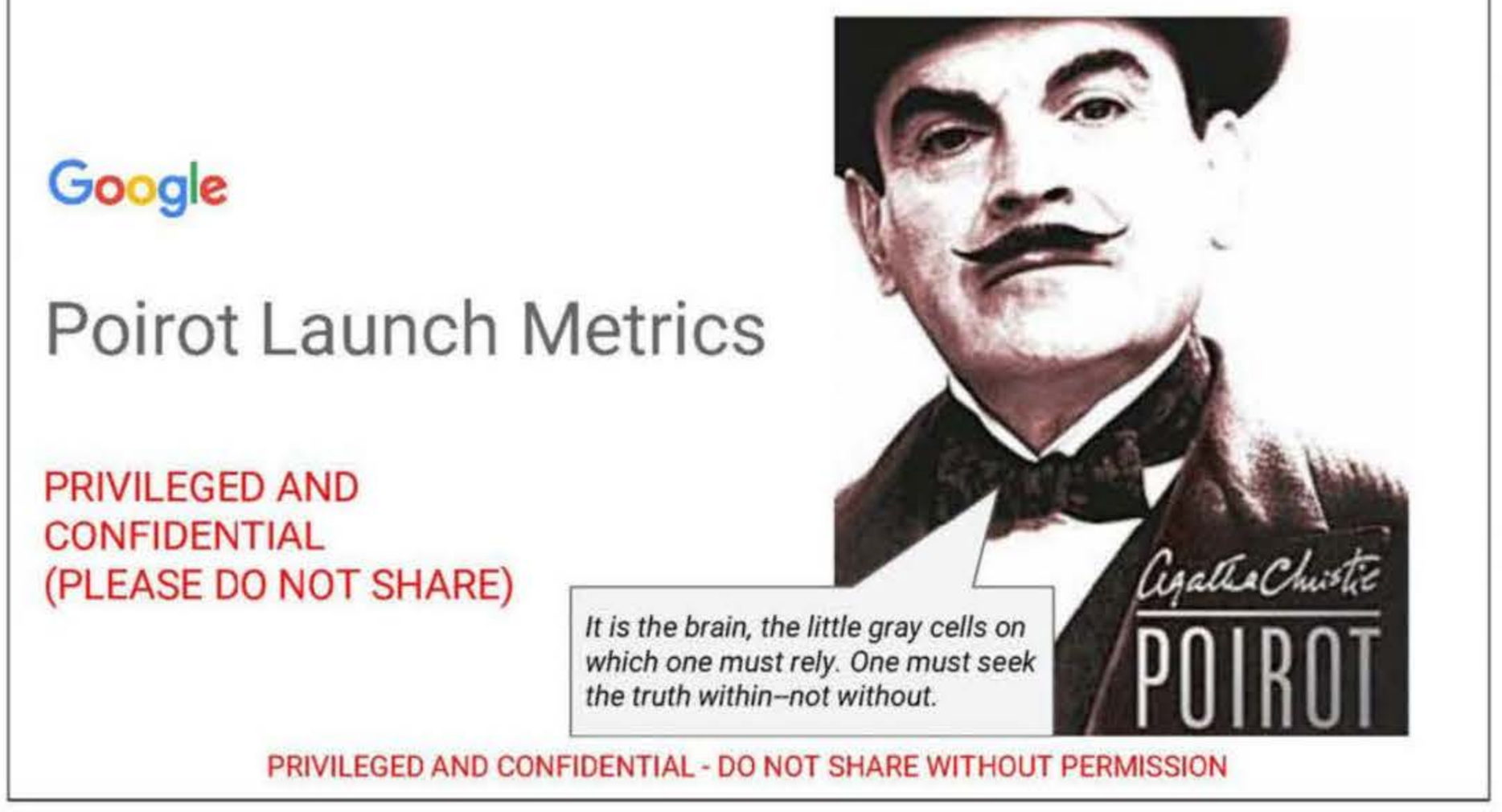

Lt. Colin Race: This murder gets more complicated by the minute.
Hercule Poirot: Mais oui. Which can only mean one thing, mon ami. The solution, it must be very simple.

PTX1126

1:23-cv-00108

Context

- We always knew that some exchanges deviate from second pricing
- We developed an algorithmic framework to detect and quantify this deviation using DBM data
- Using this framework, we have built bid optimizations to protect advertisers against price gouging in these "unclean" exchanges

In non-second price auctions, by bidding less we can still win the same impression at a lower price.

- In non second-price auctions, we can buy the same impression by bidding less
- Objective: **win the same impressions at lowest price** - savings will buy additional similar impressions

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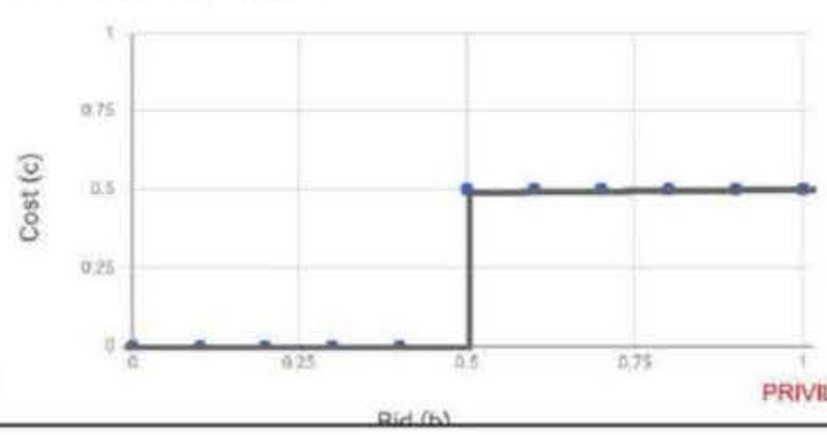
Typically implemented via soft floors or Reserve Price Optimization (RPO) using bids from current auction.□RPO setting floors based on aggregate bids is just an automated version of publishers□setting bids manually and still considered second price.

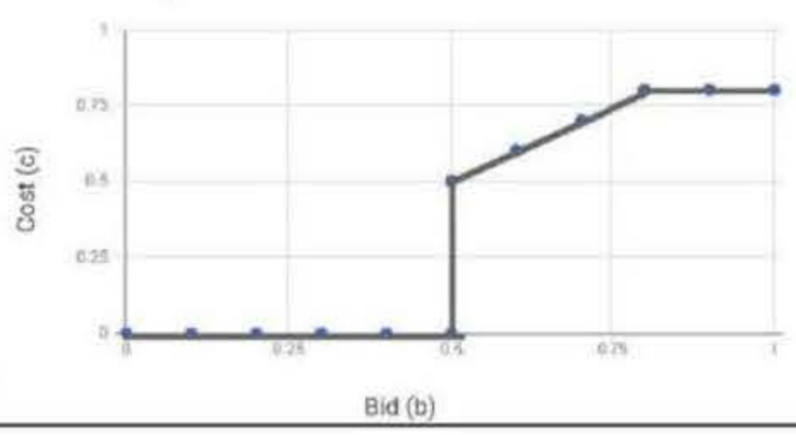
Surplus: Optimization Goal and Success Criteria

- **Assumption:** fixed CPM adv. assign a dollar value ***v*** (CPM in UI) for all impressions
  - They have to pay ***c*** to derive this value
  - We maximize surplus = **sum(*v* - *c*)** on all winning queries
- Second price auctions already optimizes for this in a trivial way
  - bidding *v* maximizes surplus

Clean second price auction



Non second price auction



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Optimization Formulation

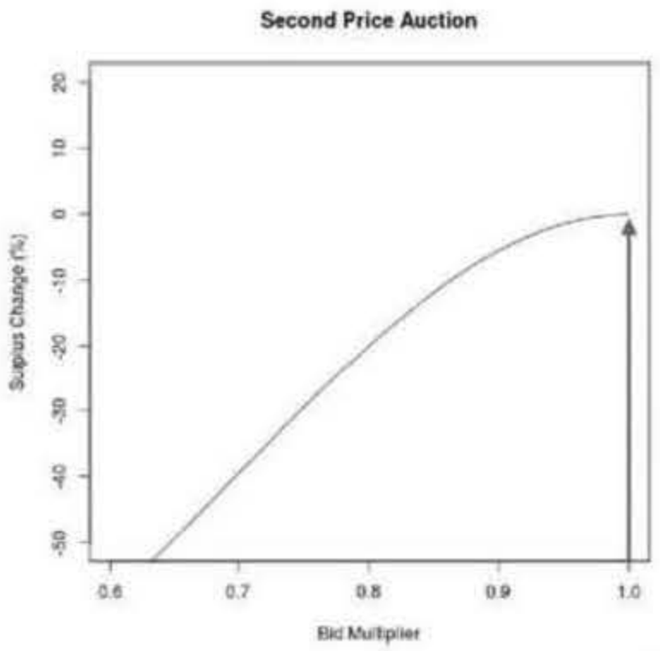
We want to adjust bids to maximize surplus:

For each advertiser find bidding policy ***f(****v, query features****)*** such that we **Maximize** $\sum(v - c)$

- we started out with ***f(****v, query features****)*** = ***α(***exchange***)*** × *v*
- in order to solve this optimization, we need to know how different ***α***'s affect the surplus
- hence, we setup exploration experiments using various values of ***α***

Surplus Change vs. Bid Multiplier

- Measured for each advertiser x exchange, from daily background experiment
- Typical shape:



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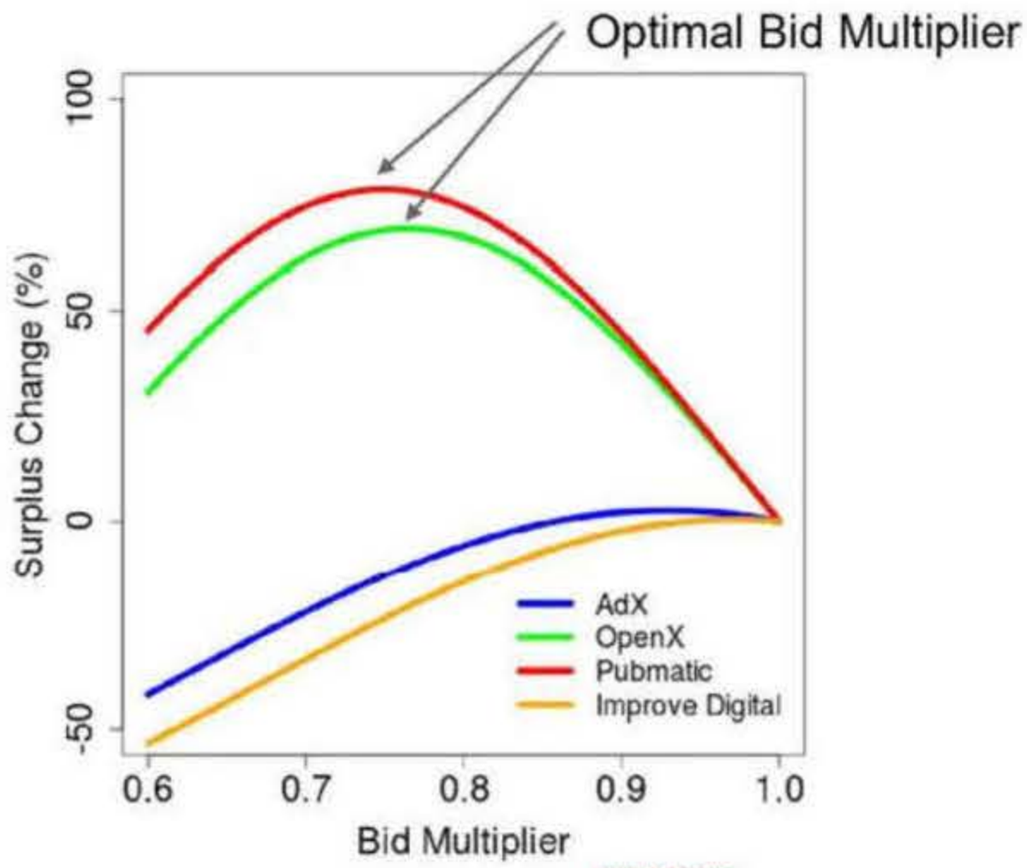
Measured surplus change plots

Measured Surplus Change vs. bid multiplier



No surplus gain:
Adx, Improve digital

Significant surplus gains:
Pubmatic, OpenX

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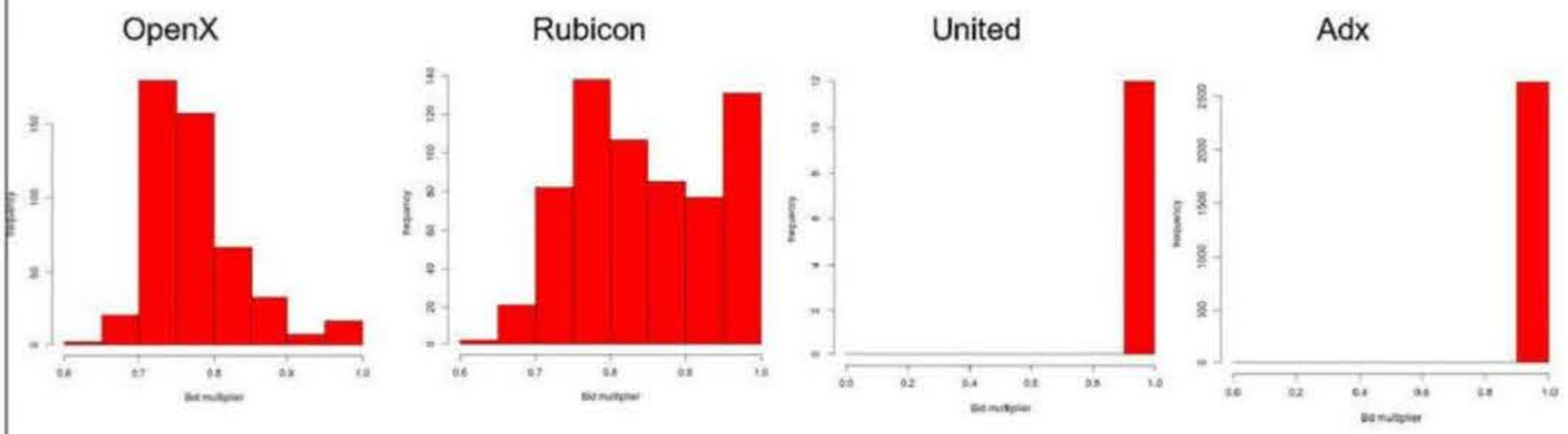
Advertisers bucketed by calculated bid multiplier; non-second price exchanges have a range of multipliers, vs. second price exchanges do not



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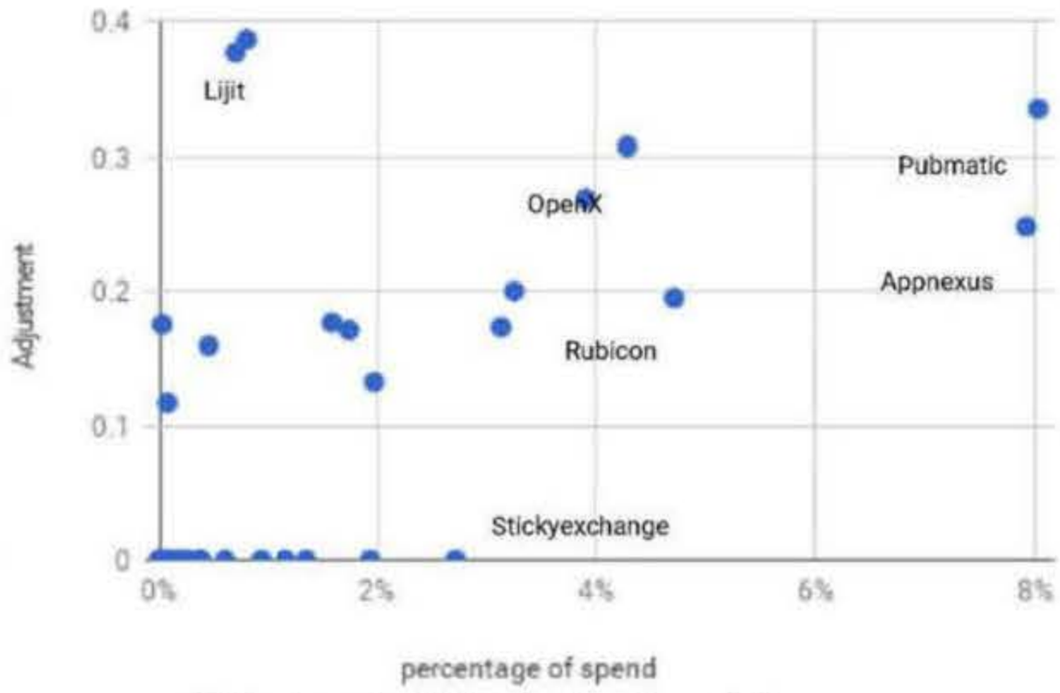
Exchange priors (used if insufficient data for given advertiser)

Adjustment vs. percentage of spend



*Adjustment = bid reduction (penalty)

- Chart does not include AdX, which is 47% of DBM, multiplier of 1 - other clean exchanges include United, Adaptv, Improve Digital…
- 70% of 3rd party exchange spend from non-second price exchanges (sheet).
- Exchange-level multipliers in line with insights from Q4 simulation-based analysis on AWBid.

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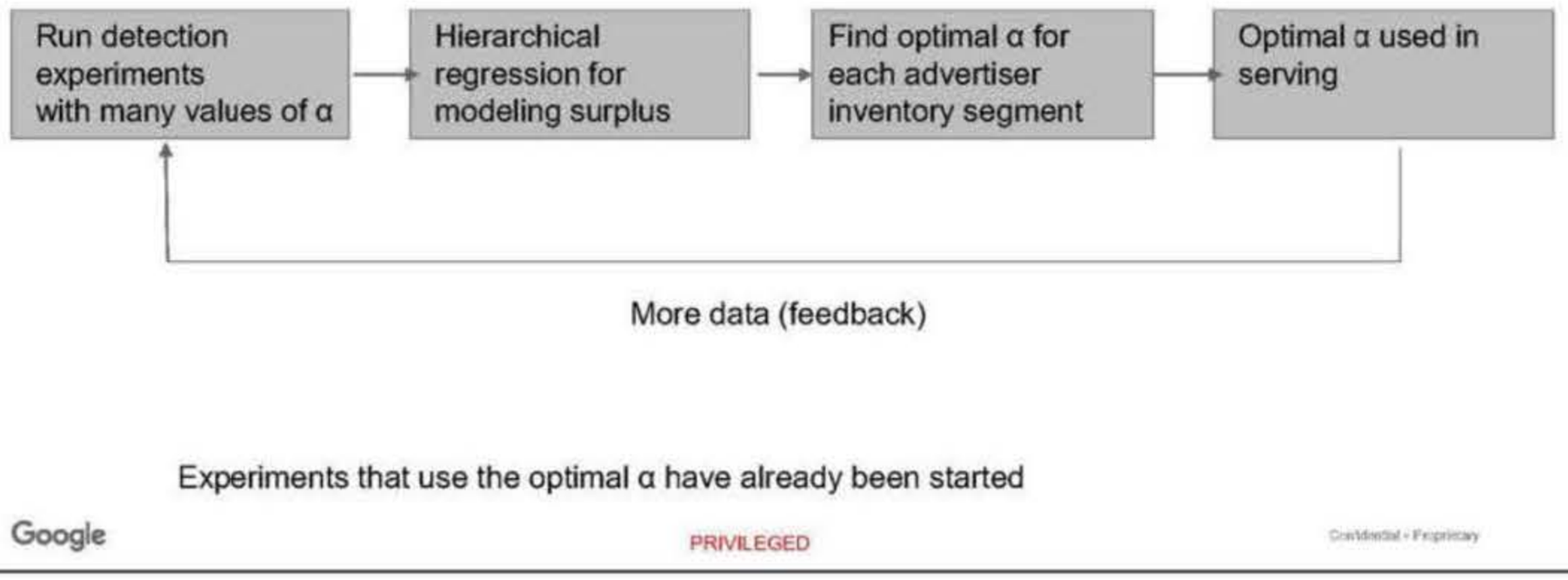
Methodology flowchart



Experiments that use the optimal α have already been started

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Full launch statistics

Detailed stats here

Metric	Revenue change in expt	Revenue change post budget redistribution	Impression change in expt	Impression change post budget redistribution
Adsense	0.26%	6.63%	0.13%	6.48%
Adx	0.96%	7.51%	1.09%	7.65%
Untreated 3p	0.61%	6.95%	0.94%	7.30%
Treated 3p	-19.93%	-14.70%	-14.73%	-9.16%
Total	-7.51%	-1.52%	-4.09%	2.09%

Advertiser REMH metrics

Metric	Value
CPD	+5%
ClicksPD	+5%
Active View PD	+7%
CPD (non-second price auction 3P)	+14%
ClicksPD (non-second price auction 3P)	+12%

Tradeoffs much better than advertisers can get with uniform bid lowering

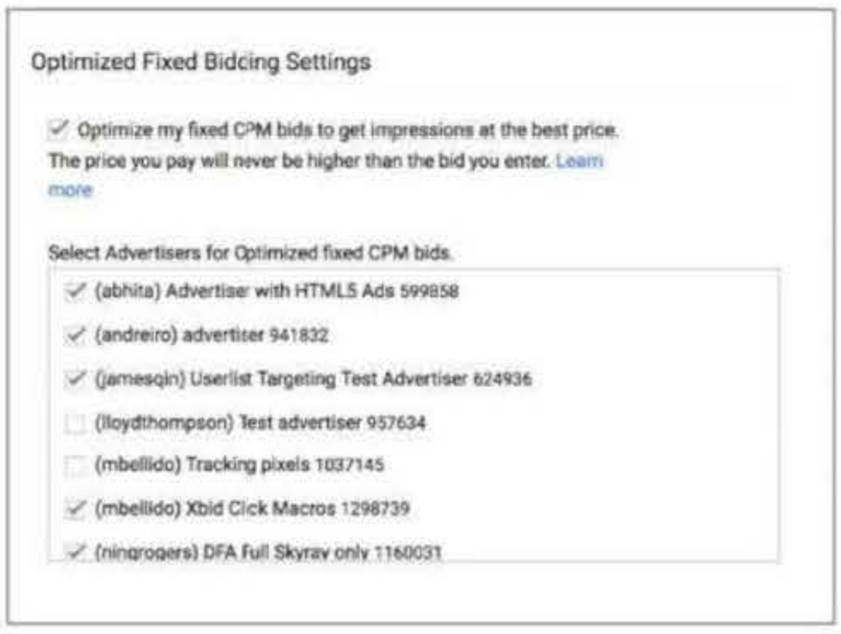
Inventory quality - neutral

Metric	Sub-metric	Change
Active view rate		0.0%
Video completion rate		0.5%
Brand metrics	**E**	0.6%
	PG	-1.8%
	T	0.3%
	MA	1.3%

Launch in phases

	Queries	Impressions	AFC RPM	Revenue	CaNoBcRevenue	CaBcRevenue
XbidBidAdjustments::DealFixControl1p 212547030 Dbm_Buyer * External_Exchange	612,199,704	13,810,240	0.0930	56,919.5465	13,418.3708	43,501.1757
XbidBidAdjustments::ScaledPoirot0p25 212547031 Dbm_Buyer * External_Exchange	608,270,513 -0.64% [-1.02, -0.26] %	13,225,845 -4.23% [-4.72, -3.74] %	0.0882 -5.18% [-5.94, -4.42] %	53,624.2265 -5.79% [-6.59, -4.99] %	12,638.5903 -5.81% [-7.18, -4.44] %	40,985.6362 -5.78% [-6.51, -5.06] %
XbidBidAdjustments::ScaledPoirot0p50 212547032 Dbm_Buyer * External_Exchange	607,179,923 -0.82% [-1.31, -0.33] %	12,740,131 -7.75% [-8.22, -7.28] %	0.0841 -9.57% [-10.14, -9.01] %	51,048.1303 -10.32% [-10.98, -9.65] %	11,995.4463 -10.60% [-11.81, -9.40] %	39,052.6841 -10.23% [-10.93, -9.52] %
XbidBidAdjustments::ScaledPoirot0p75 212547033 Dbm_Buyer * External_Exchange	603,311,559 -1.45% [-1.92, -0.98] %	12,280,702 -11.08% [-11.55, -10.60] %	0.0802 -13.78% [-14.34, -13.23] %	48,360.9979 -15.04% [-15.66, -14.41] %	11,358.2569 -15.35% [-16.43, -14.28] %	37,002.7410 -14.94% [-15.64, -14.24] %
XbidBidAdjustments::ScaledPoirot1p0 212547034 Dbm_Buyer * External_Exchange	591,978,235 -3.30% [-3.68, -2.93] %	11,816,651 -14.44% [-14.89, -13.98] %	0.0780 -16.08% [-16.67, -15.48] %	46,190.6474 -18.85% [-19.39, -18.31] %	10,892.0100 -18.83% [-19.77, -17.89] %	35,298.6375 -18.86% [-19.45, -18.26] %

Controls in Partner UI w/ Advertiser-level Opt-out



Partners can choose to opt out as a whole or for individual advertisers.

Comms will be:

"To date, fixed bidding in DBM has always bid the the exact inputted CPM/1000 for every impression. Now, **in order to ensure advertisers are getting the best possible price for each impression, we launching an optimization with the goal of winning the same impression for a lower price. "**

Launch plan

- **June 2nd week:** Start launch (phase 1)
- **Around launch time:** Communicate to advertisers and launch announcement
- **Last week of June/ early July:** Final launch (phase 4)

Advertiser performance tracking

- For DBM, we estimate max_spend ignoring budget. actual_spend / max_spend indicated extent of budget constraint (1 = not BC)
- If Poirot reduces spend by more than actual_spend / max_spend, we won't be able to spend all budget
- Using this, we can identify customer at risk of not spending their entire budget, and target comms at them/ opt them out
- Using this approach, we see that 175 customers have over $40000 annual spend and could lost over 20% of their spend (some are not BC anyway) after the full launch. These account for 1% DBM spend.
  - Opt them out ourselves
  - Opt them in for phase 1 and then ask them to increase bids (and opt them out if that doesn't work) - preferred option

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Appendix

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Purpose of the Beta launch

- We are planning to launch Poirot first on about 1500 partners, amounting to 11% by spend
- The main purpose is to mostly make sure nothing is seriously broken and get some idea about budget redistribution
- Beta advertisers are at a disadvantage compared to non-beta advertisers + exploration experiments don't represent the Beta launch accurately
  - Measurements will not be accurate in the Beta launch
  - There is a higher risk of underspend in the Beta launch than in the full launch
  - More details in this doc

Beta launch statistics

Detailed stats here

Metric	Revenue change in expt	Revenue change post budget redistribution	Impression change in expt	Impression change post budget redistribution
Adsense	0.00%	0.71%	0.13%	0.84%
Adx	0.22%	0.94%	0.40%	1.12%
Untreated 3p	-0.19%	0.51%	0.16%	0.86%
Treated 3p	-2.55%	-1.83%	-1.79%	-1.07%
Total	-0.95%	-0.24%	-0.37%	0.35%