

Poirot v2.0

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tl:dr

- Poirot is a framework for bid shaving in non-second-price auction exchanges. It only applies to Fixed CPM DBM traffic.
- In this launch candidate, we incorporate auction type query feature, lower the floor on bid shaving to 0.1, and revise the model to improve accuracy.
- On 3PE (third party exchanges) we see an aggregate surplus increase of 8.8% over all DBM traffic and 13.6% over Fixed CPM DBM traffic. This comes at a revenue loss of -19.7%. Since 76.5% of DBM revenue on 3PE is budget constrained, we project this loss to be at -14.4%.
- On AdX and AdSense this launch is a no op (same as production). Adjusting for budget we project revenue gain of 7.29%.
- Total projected revenue loss is -1.26% while net revenue increases by 3.39% which translates to +41\$M annualized. Note: the original Poirot launch was twice as impactful, but post launch we didn't see any revenue drop because exchanges adapt their pricing models (soft floors etc). So, there is a good chance, we won't see much of the 1.26% gross revenue loss here either.

Current Poirot Version

<https://ariane.googleplex.com/launch/215784> uses the following features to lower bids for fixed CPM DBM advertisers to protect them for exchanges deviating for second price auction.

1. Exchange id
2. Customer id
3. Bid bucket

Methodology: Run background experiments with different bid lowering. Build a model for surplus¹ $S_{adv}(\alpha)$ for each advertiser x exchange x bid bucket as a function of bid scaling α and we pick and serve the α that maximizes surplus for given advertiser on given exchange.

Summary of proposed changes

Detailed model design.

- Include auction type in poirot: Starting this year many exchanges are sending us the auction pricing type which can be: 0 for unspecified, 1 for first pricing and 2 for second pricing.
- Lower the floor on bid shaving from 0.6 to 0.1.
- Model changes: Change response from relative surplus to normalized surplus. Change the model from log quadratic to linear cubic to improve fits and accuracy.

¹ Surplus is defined as value - cost. For Fixed CPM advertisers value = Bid.

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- Remove customer id. Past experiments have shown surplus gains when customer id is excluded from the model (TODO add a link).

Aggregated Results

1% experiment from Aug 11, 2018 till Aug 19, 2018. [Rasta link](#)

Slice	Surplus	Revenue	Payout	Value	Win Rate
DBM x 3PE	8.8% [8.3, 9.3]	-19.7% [-19.8, -19.6]	-20.1% [-20.2, -20.0]	-7.7% [-8.0, -7.5]	-10.0% [-10.1, -9.9]
DBM x AdX	0.12% [-0.4, 0.7]	0.34% [0.2, 0.5]	0.30% [0.2, 0.4]	0.14% [-0.3, 0.6]	0.42% [0.3, 0.5]
Fixed CPM DBM x 3PE	13.6% [13.2, 14.0]	-31.4% [-31.5, -31.2]	-32.2% [-32.3, -32.1]	-13.2% [-13.4, -13.0]	-21.2% [-21.3, -21.1]

The new poirot model turns out to be a no-op on AdX similar to the prod model. Since the experiments are not budget controlled, we project the following metrics on launch.

Budget Adjustments Calculations

Exchange	Revenue (Prior budget adjustments)	Revenue (After budget Adjustments)	Net revenue (After Budget Adjustments)
3PE	-19.7%	-14.40%	-14.40%
Adx + AdSense	0.34%	7.29%	7.29%
Total	-7.6%	-1.26%	3.39%

3.39% increase in overall profit translates to \$41M annualized net revenue inc

Results per exchange

Impact on major exchanges aggregated by all DBM traffic.

Exchange	Surplus	Revenue
Appnexus	20.3%	-31.4%
CasaleMedia	19.5%	-26.5%
Rubicon	10.3%	-22.3%
Bidswitch	7.8%	-18.4%

OpenX	9.7%	-42.0%
Pubmatic	-6.6%	-26.4%
TremorVideo	2.3%	2.2%
Teadstv	-0.8%	1.0%
RightMedia	27.0%	13.7%
Spotxchange	1.0%	-3.4%
Adaptv	2.8%	2.5%
Adtech	38.3%	20.1%

Now we look at the impact on major exchanges restricted to fixed CPM DBM traffic. This is the slice Poirot is active on. We also add results from advertiser distribution analysis:

Exchange	Surplus	Revenue	Percent of advertisers with increased surplus
Appnexus	28.7%	-50.4%	84.7%
CasaleMedia	22.5%	-46.2%	91.9%
Rubicon	11.2%	-37.3%	86.8%
Bidswitch	11.9%	-27.2%	81.2%
OpenX	12.6%	-65.2%	75.1%
Pubmatic	-7.8%	-37.8%	70.5%
TremorVideo	3.4%	2.7%	58.4%
Teadstv	-0.7%	1.5%	46.6%
RightMedia	30.9%	18.5%	76.0%
Spotxchange	0.4%	-4.8%	58.4%
Adaptv	3.1%	3.2%	76.5%
Adtech	46.9%	31.6%	93.9%

Case study: Appnexus

This is an interesting example for two reasons: Appnexus is the biggest 3PE and they seem to be actually running true second price auction for inventory with auction type 2 (second price).

Auction Type	Poirot bid lowering	Surplus	Revenue	Frac of total spend
First pricing	0.38x	31.4%	-38.4%	91%
Second pricing	1x (no lowering)	3%	32.7%	7%

Exchange: 10 Auction type: 1

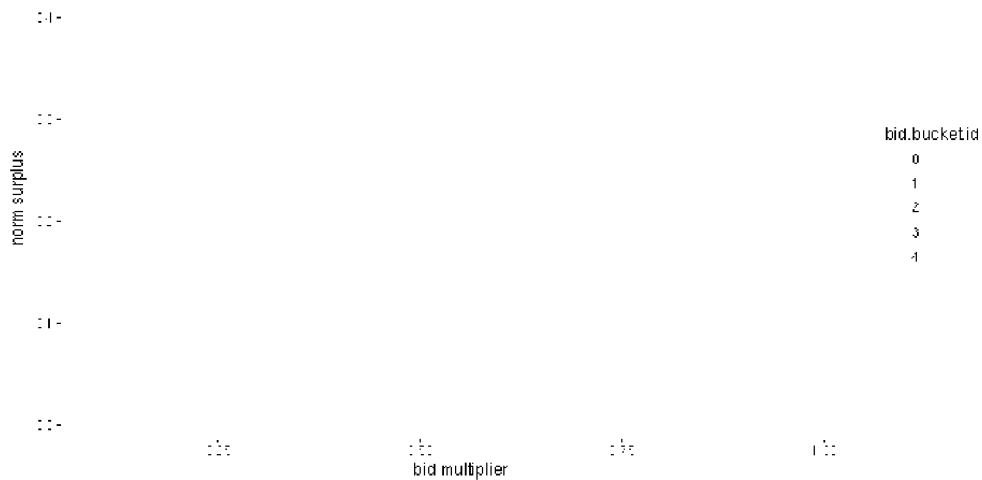


Figure 1: Surplus curves for auction type 1 (first pricing). We have 5 curves for 5 bid buckets. The dots are the raw observations from the background experiments. The optimal multipliers are marked by *. For all the bid buckets surplus can be increased significantly by lower bids by ~0.4x

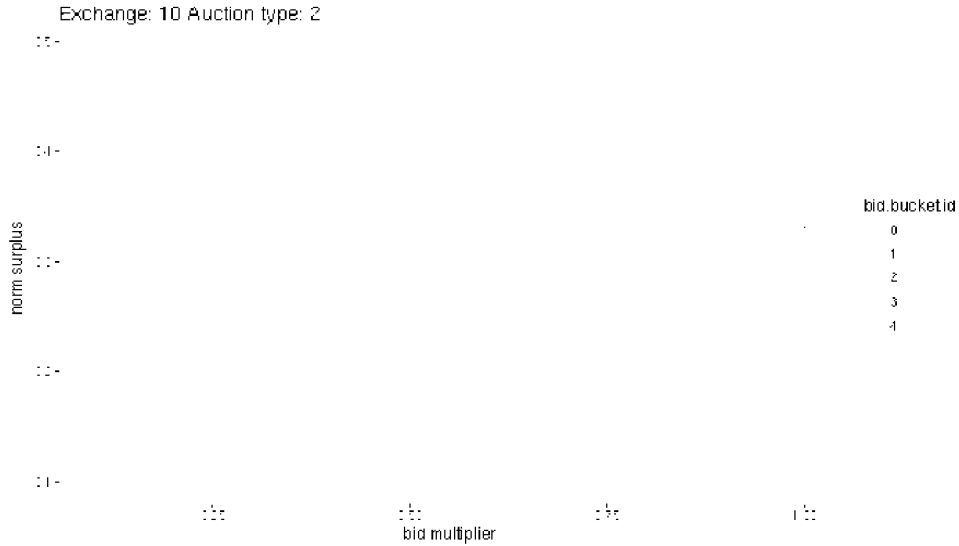


Figure 2: Surplus curves for auction type 2(second pricing). We have 5 surplus curves for 5 bid buckets. The dots are the raw observations from the background experiments. The optimal multipliers are marked by *. Surplus reduces in most bid buckets by lowering bids.

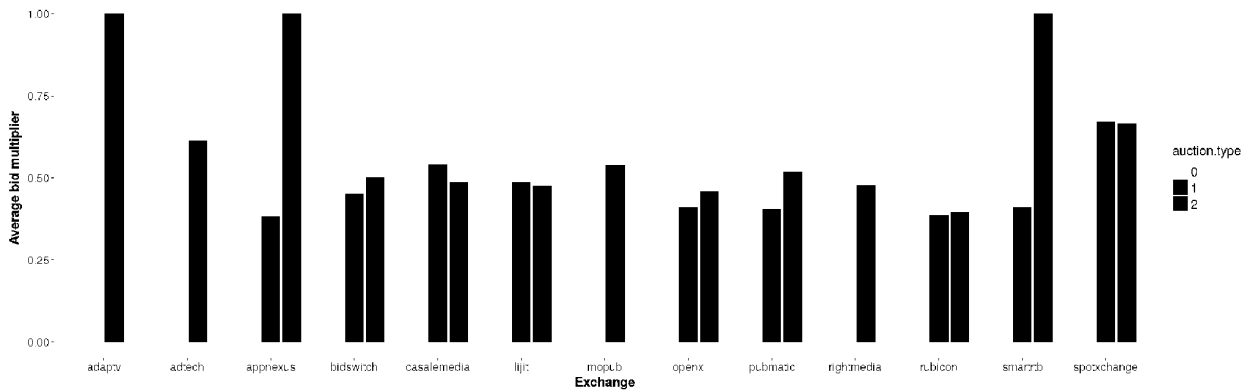


Figure 3: Average multipliers for major 3PEs. Adaptv, Appnexus, and SmartRTB appear to be the only exchanges running clean second price auctions (bid multiplier = 1 for auction type 2).

Figure 3 confirms that for most exchanges, multipliers may vary widely based on the provided auction type, whether or not truthful.

Impact of different changes

This launch candidate is changing multiple things: new model for surplus, introduce auction type as a feature and lower the floor on bid lower from 0.6 to 0.1. The following experiments capture the effect of each of these.

1% experiment from Aug 11, 2018 till Aug 23, 2018. [Rasta link](#)

Expt	Min Mult	Model	Auction type	Surplus	Revenue
Prod	0.6	Old	No		
	0.1	Old	No	Model failure	
212547104	0.6	New	No	5.50%	-10.28%
212547105	0.1	New	No	9.74%	-26.54%
212547107	0.6	New	Yes	5.47%	-9.59%
212547108	0.1	New	Yes	13.47%	-31.61%

Table: Relative to production metrics for different experiments for fixed CPM DBM traffic on 3PE. 212547108 is the launch candidate. We couldn't run a flavor of prod with min multiplier = 0.1 since the pirot surplus model fails. Just the new model (212547104) gives us a surplus gain of 5.5%. Mult multiplier of 0.1 with new model gets us to 9.74%. A combination of all three gets us 13.47% increase in surplus.