

# Application Experiment Analysis Endpoints

## Summary

### Outline

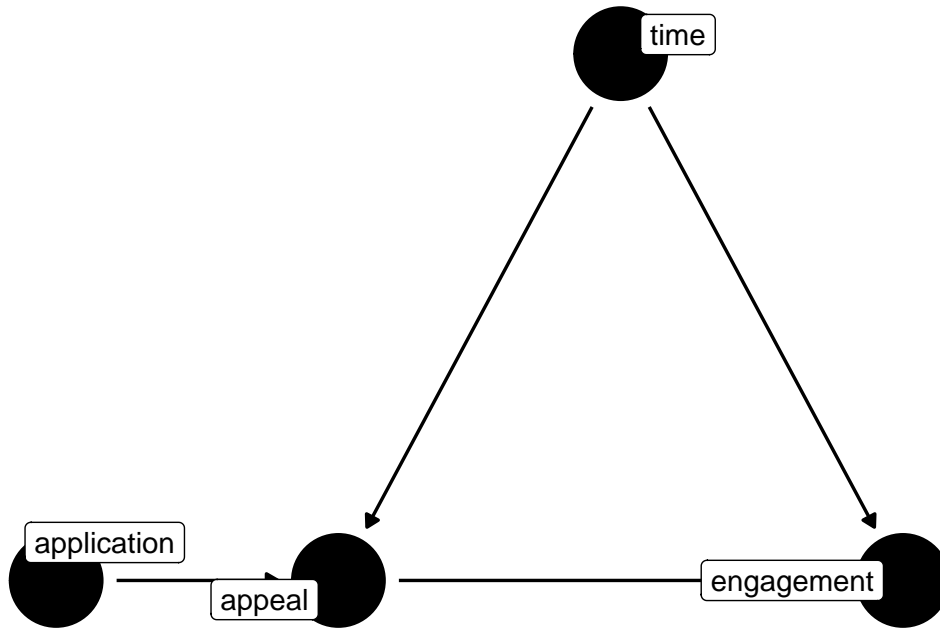
- Goal of this project is to allow the capturing of data in the job application process to generate actionable insights for the applicant
- The medium of presentation will be a dashboard featuring KPIs and statistical models
- Models will be used to give concrete estimation of a testable hypothesis (i.e. for A/B testing of resumes)
- 3 models proposed:
- Poisson regression of job portfolio website views
- Logistic regression of positive contact (i.e. not a rejection) after application
- Kaplan-Meier models on unemployment survivorship
- Data for poisson model should only be taken as long as applications are being actively sent out
- Data for logistic and Kaplan-Meier models can be obtained after application period

### Experimental Guidelines

- To differentiate website views coming from different applications, UTM labels will be appended on website links attached to each resume
- Applications should be sent out at a constant rate
- Try to keep job specifications as consistent as possible (e.g. only jobs that you are qualified for)
- Recommended to have a negative control for baseline engagement

## A/B Testing Website Views

### Causally Modeling A/B Testing



- Time frame of comparison is short and thus economic factors are unlikely to change over course of testing removing the need to control for economic factors

### Simulation Study

- Simulation of study ran for differing days, replicates and assumed effect size
- Statistical power was defined as proportion of regression results with p-value less than 0.1
- Target acceptable statistical power is 80%
- Different model specifications were tested to determine best estimator of true effect
- Poisson without fixed effects
- Poisson with fixed effects on date and replicates
- OLS with fixed effects on date and replicates

n	r	effect	lambda	model	coef_mean	coef_sd	se_mean	se_sd	power
30	2	0.1	5	ols	0.10130853	0.09001642	0.08991372	0.0123629079	0.302
30	2	0.1	5	poisson-base	0.09506729	0.07863602	0.07977055	0.0016387672	0.325
30	2	0.1	5	poisson-fixed	0.09506729	0.07863602	0.07903928	0.0103720276	0.338

30	3	0.1	5	ols	0.10181298	0.07368187	0.07450261	0.0101782464	0.377
30	3	0.1	5	poisson-base	0.09587377	0.06512103	0.06523293	0.0009952500	0.432
30	3	0.1	5	poisson-fixed	0.09587377	0.06512103	0.06548346	0.0086386176	0.431
45	2	0.1	5	ols	0.09998511	0.07359497	0.07403195	0.0085039449	0.377
45	2	0.1	5	poisson-base	0.09550456	0.06532985	0.06520167	0.0010946435	0.429
45	2	0.1	5	poisson-fixed	0.09550456	0.06532985	0.06493931	0.0069544729	0.441
45	3	0.1	5	ols	0.10071879	0.06384523	0.06039519	0.0070730727	0.516
45	3	0.1	5	poisson-base	0.09604026	0.05606973	0.05323098	0.0007145115	0.579
45	3	0.1	5	poisson-fixed	0.09604026	0.05606973	0.05305805	0.0059439426	0.582
30	2	0.2	5	ols	0.19282303	0.09041089	0.08904930	0.0125355201	0.680
30	2	0.2	5	poisson-base	0.18114174	0.07837653	0.07834434	0.0015040819	0.756
30	2	0.2	5	poisson-fixed	0.18114174	0.07837653	0.07817448	0.0103737708	0.738
30	3	0.2	5	ols	0.19325138	0.07315367	0.07275290	0.0100442940	0.814
30	3	0.2	5	poisson-base	0.18224106	0.06411961	0.06389468	0.0010275554	0.890
30	3	0.2	5	poisson-fixed	0.18224106	0.06411961	0.06391056	0.0084129886	0.881
30	3	0.2	3	ols	0.16611554	0.08705250	0.08510531	0.0113125104	0.606
30	3	0.2	3	poisson-base	0.18141429	0.08554412	0.08255182	0.0017702877	0.701
30	3	0.2	3	poisson-fixed	0.18141429	0.08554412	0.08255336	0.0111161874	0.694

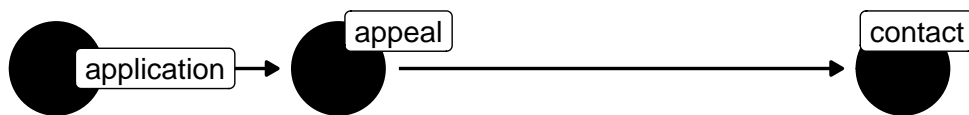
- With an estimated effect size of 0.1 between applications tested, 45 days at 3 replicates is minimally required for statistical power of 80%
- With an estimated effect size of 0.2, 30 days at 2 replicates is sufficient for ~75% power though it is not the ideal of 80%
- Assumed rate needs to be about 5 per day for these power estimates to be valid - lower seems to greatly reduce estimates (likely because of the overabundance of zeros when fixing on date)
- May have more power to look at page views or total clicks or total events
- E.g. Assume you make it past screening filters to a real person at 50% of the time. Assume then this person looks at your page. There is an average minimum of 4 events (landing -> about -> scroll -> projects) (low interest). There is a average of 7 clicks (landing -> about -> scroll -> project -> demo -> article -> scroll) (medium interest). There is an average maximum of 12 events (landing -> about -> scroll -> project -> demo -> article -> scroll -> project2 -> demo2 -> article2 -> scroll) (high interest). Assume even spread of interest (i.e. ~33% each) There may also be return visits based on strong interest. Let's assume 4 page views for repeat visits. Assuming return interest to be about 50% of interest...will give an estimate 4.833  $((4+7+12)/3 + 4*0.5)/2$ . This is relatively idealized.
- Could increase replicates to 3 which gives a greater than 80% of power
- 3 replicates achieves a power rate of 70% with a rate of 3 per day
- Suggested to use 3 replicates to be safe
- OLS tends to perform better at estimating the true effect but with lower power and incoherent errors (e.g. predicted views lower than 0)

## Conclusion

- Predicted effect size should be considered prior to starting experiment
- Experiment length should not be greater than 30 days
- Lower number of replicates is preferable
- It is recommended that only predicted effect sizes of 20% or greater should be tested

## A/B Testing Contact

### Causal Model



- We will make the assumption that date of application is irrelevant (i.e. we can pretend that all applications were sent out on the same day)

### Simulation Study

n	r	effect	model	coef_mean	coef_sd	se_mean	se_sd	power
30	2	0.2	logistic	1.429352	0.6015371	0.4371816	0.3381685	0.854
30	3	0.1	logistic	1.409617	0.4486995	0.3890079	0.2020877	0.947

- 30 days at 2 replicates is sufficient for a minimal statistical power of 80%

## **Interview Survivorship**

- KP curves for each treatment with output being contact/failure
- A log rank test can be used to test for differences in curves
- Establishing differences in effect sizes of applications is not required for this model's usefulness

## **KPIs**

- Total applications sent
- Total days since experiment start
- Website views per job application
- Website views per interview
- Interviews per job application