Is a sample always representative of the population?
No WAYS!
Is random sampling the same as random assignment of an intervention?
No WAYS!
Can sampling be fun?
\[
n = \left[ \frac{4\sigma^2 (z_{1-\alpha/2} + z_{1-\beta})^2}{D^2} \right] \left[ 1 + \rho(m-1) \right] \left[ 1 - r \right]
\]
This presentation covers two questions:

Why is sample size important?
  • Approx time: 2 mins

How big should my sample be?
  • Approx time: a lifetime of pain and anguish
Q1: Why is sample size important?
Why is sample size important?

Imagine you had to sample letters to “estimate” what the sentence says:

```
S
T H
M N
```
Why is sample size important?

Imagine you had to sample letters to “estimate” what the sentence says:
Why is sample size important?

Imagine you had to sample letters to “estimate” what the sentence says:

```
SHOW ME
THE MONEY
```
Why is it important for IE?

We want to know the true impact
But we need to estimate this impact from a sample
Estimation means we can sometimes make mistakes
Making mistakes can be costly...

**Type I error**
(false positive)

You're pregnant

**Type II error**
(false negative)

You're not pregnant
Q2: How big should my sample be?
The answer is...

\[ N = \left[ \frac{4\sigma^2(z_{\alpha/2} + z_\beta)^2}{D^2} \right] \left[ 1 + \rho(H - 1) \right] \]

= 42
The End

• Questions?
A better question...

What influences the sample size I need?

• Size of impact
• Variation in outcome
• Level of clustering
• Take up
What influences the sample size I need?

- Size of impact
- Variation in outcome
- Level of clustering
- Take up
What influences the sample size I need?

1. Size of impact
2. Variation in outcome
3. Level of clustering
4. Take up
Size of impact

Big impacts are easy to identify

Small impacts are more difficult
Need more precision/accuracy
Larger sample needed
Minimum detectable effect

• We need a sample size able to detect the smallest effect size of importance.

• To guide this decision we need to ask:

“What is the smallest effect size that, if it were any smaller, the intervention would not be worth the effort?”
Mo money mo power

Sample Size

Percentage difference
Need to be realistic

![Graph showing the relationship between sample size and percentage difference]
What influences the sample size I need?

1. Size of impact
2. Variation in outcome
3. Level of clustering
4. Take up
Which group has more to sell?

- How does the variance of the outcome affect our ability to detect an impact?
How does the variance of the outcome affect our ability to detect an impact?

Now... which group has more to sell?
Which instance requires a larger sample?
In sum:
- More underlying variance (heterogeneity)
- \( \rightarrow \) more difficult to detect difference
- \( \rightarrow \) need larger sample size

**Tricky:** How do we know about heterogeneity before we decide our sample size and collect our data?
- Ideal: pre-existing data ... but often non-existent
- Can use pre-existing data from a similar population
- Example: enterprise surveys, labor force surveys
- Common sense
What influences the sample size I need?

- Size of impact
- Variation in outcome
- Level of clustering
- Take up
Clustered (1/4)

Sample size required increases, the higher the level of intervention assignment

- Business level
- Business group level
- Village/port/…
- Province?

Even if unit of analysis is the firm, if level of randomization is at province (cluster) level, we run into challenges quickly…
Clustering (2/4)

What is the added value of more samples in the same cluster?

Village 1

Village 2

Village 3

Village 4
Clustering (4/4)

**Takeaway**

- Larger *within cluster* correlation (guys in same cluster are similar)
- lower marginal value per extra sampled unit in the cluster
- higher sample size/more clusters needed than a simple random sample.

**Rule of thumb:** at least 40 clusters per treatment arm
What influences the sample size I need?

- Size of impact
- Variation in outcome
- Level of clustering
- Take up
Oversubscription
Over-optimistic
Take up vs. sample size

![Graph showing the relationship between sample size and proportion of firms taking up intervention. The x-axis represents the proportion of firms taking up the intervention, ranging from 1 to 0.3, and the y-axis represents the sample size, ranging from 0 to 6000.]
A real-life example

Matching grant application vs. completion rates

- Applications: 564
- Due-diligence completed: 417
- Approved or under review: 252
- Approved: 165
- Completed: 51
Who to interview is ultimately determined by our research/policy questions

How Many:

<table>
<thead>
<tr>
<th>Elements:</th>
<th>Implication for Sample Size:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The smaller effects that we want to detect</td>
<td>The larger the sample size will have to be</td>
</tr>
<tr>
<td>The more underlying heterogeneity (variance)</td>
<td></td>
</tr>
<tr>
<td>The more clustering in samples</td>
<td></td>
</tr>
<tr>
<td>The lower take up</td>
<td></td>
</tr>
</tbody>
</table>
How can we boost power

- Focus on homogenous group (if applicable)
- High frequency data on core indicators
- Increase take up
- Better quality data (it's worth it...)
- Avoid clustering where possible