

# **Introductory econometrics - Illustrations**

Free to use, happy to receive a mention if you find this useful  
for your class.

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Simon Heß

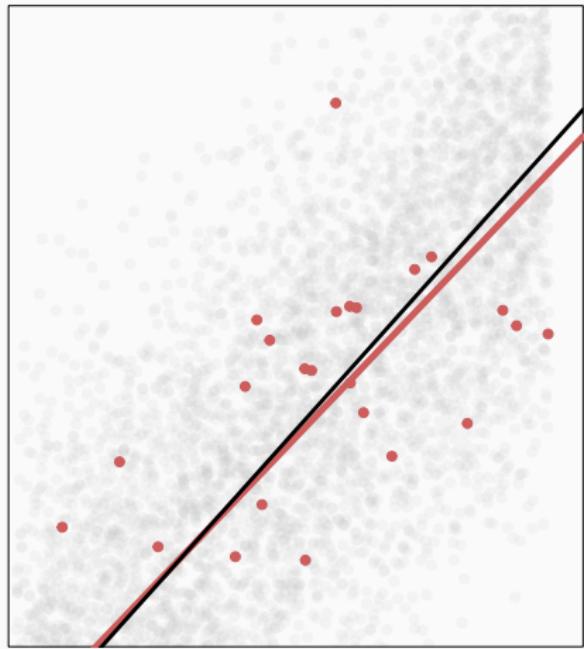
Winter 22/23

## **Sampling distribution of OLS**

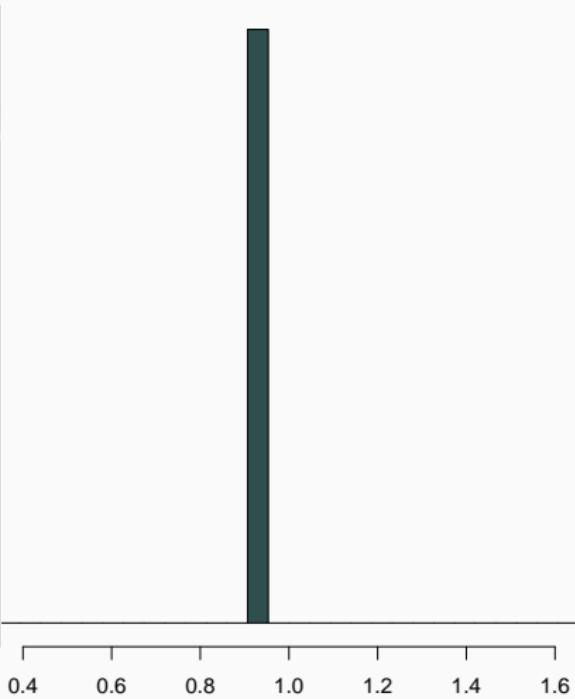
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# Sampling distribution of OLS

1 line fits on 1 samples

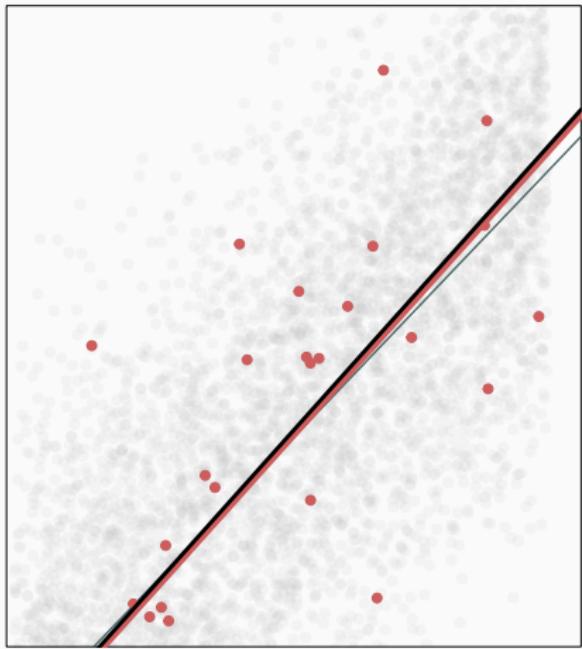


histrogram of beta 1 across 1 samples

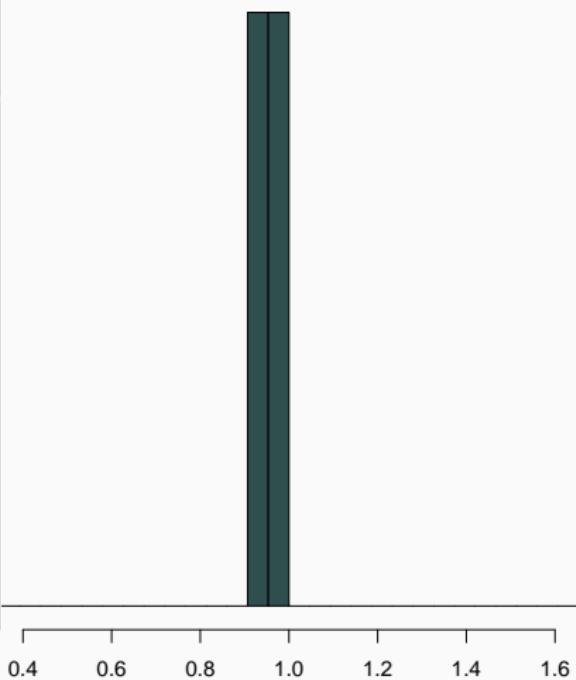


# Sampling distribution of OLS

2 line fits on 2 samples

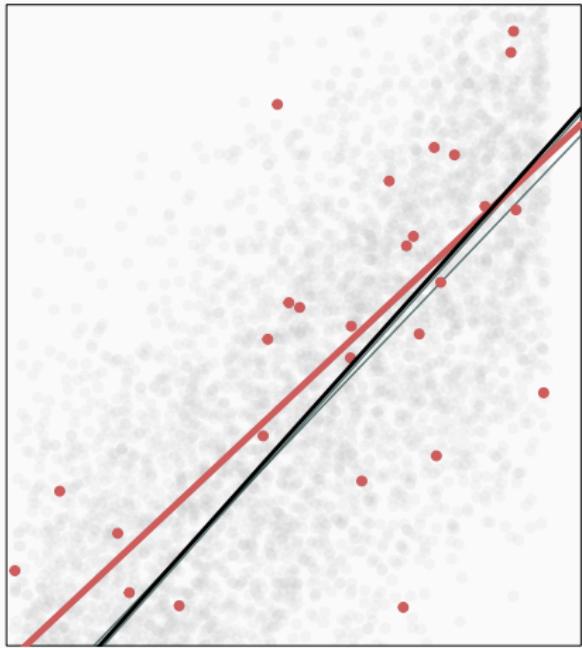


histrogram of beta 1 across 2 samples

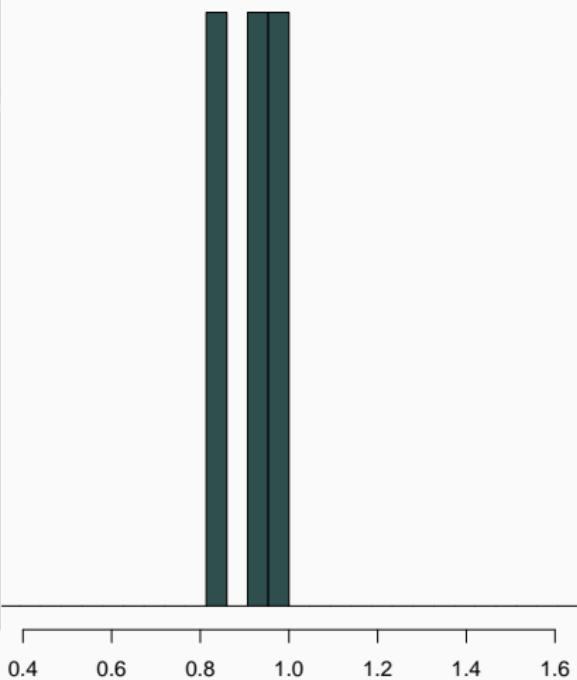


# Sampling distribution of OLS

3 line fits on 3 samples

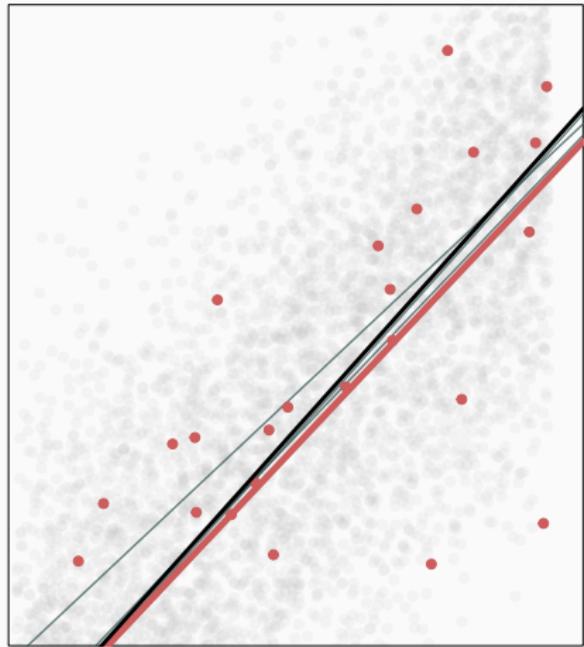


histrogram of beta 1 across 3 samples

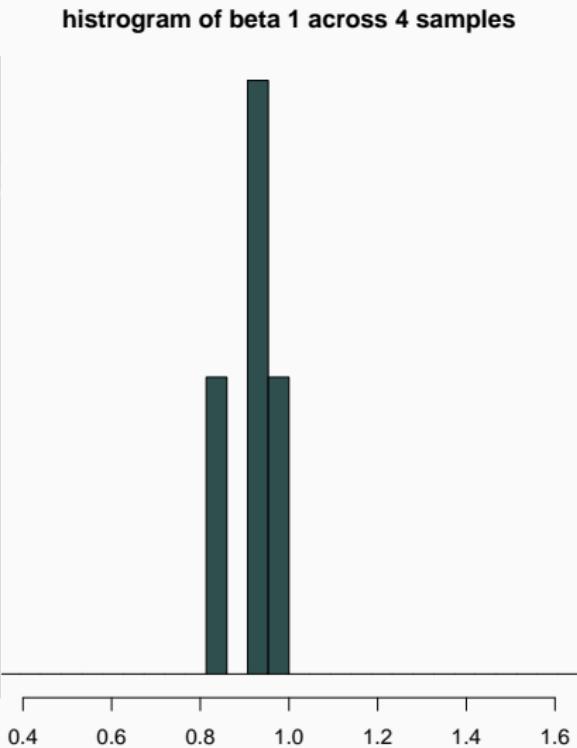


# Sampling distribution of OLS

4 line fits on 4 samples

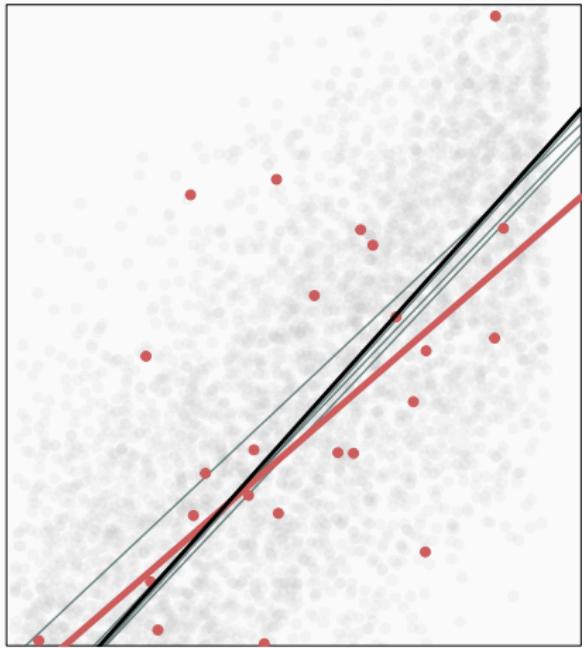


histrogram of beta 1 across 4 samples

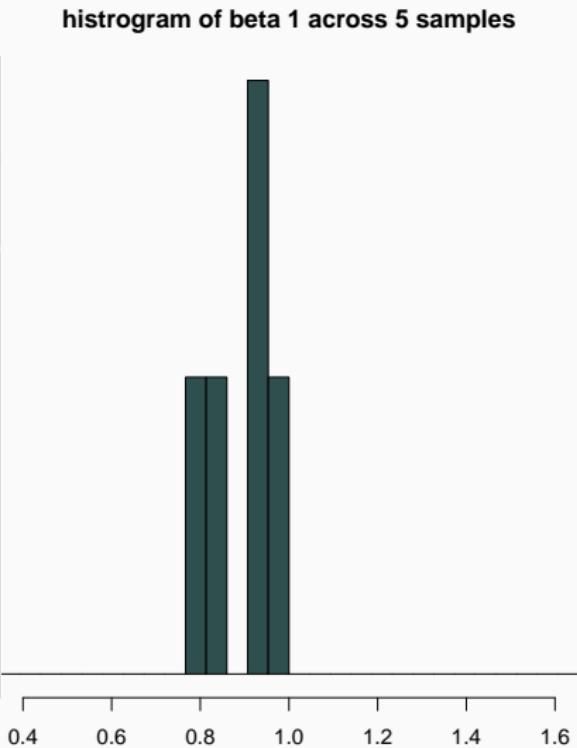


# Sampling distribution of OLS

5 line fits on 5 samples

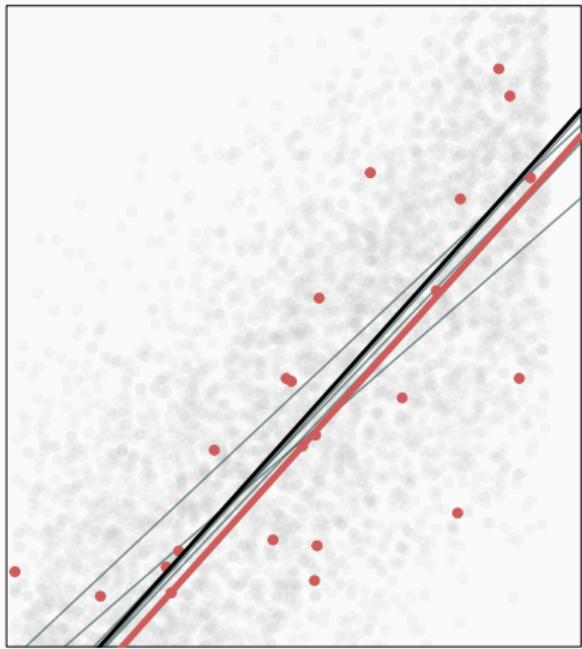


histrogram of beta 1 across 5 samples

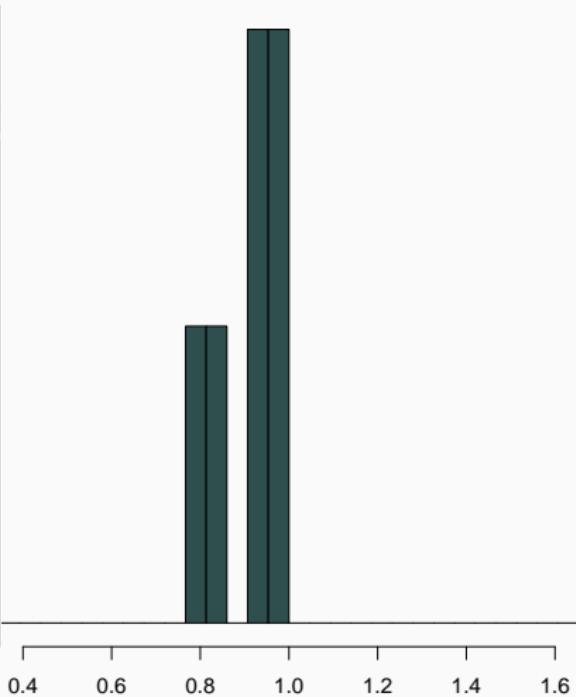


# Sampling distribution of OLS

6 line fits on 6 samples

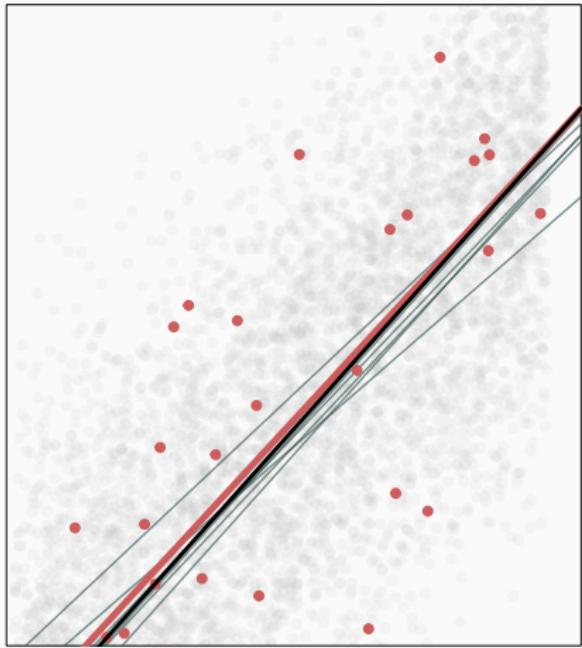


histrogram of beta 1 across 6 samples

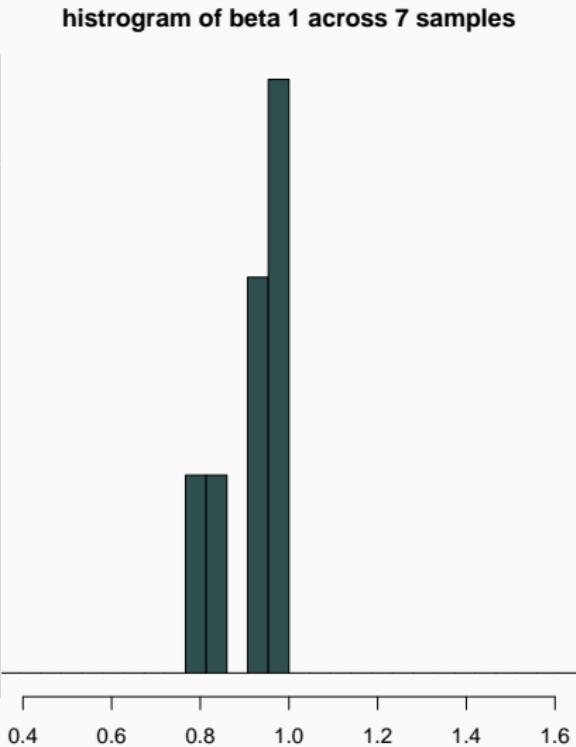


# Sampling distribution of OLS

7 line fits on 7 samples

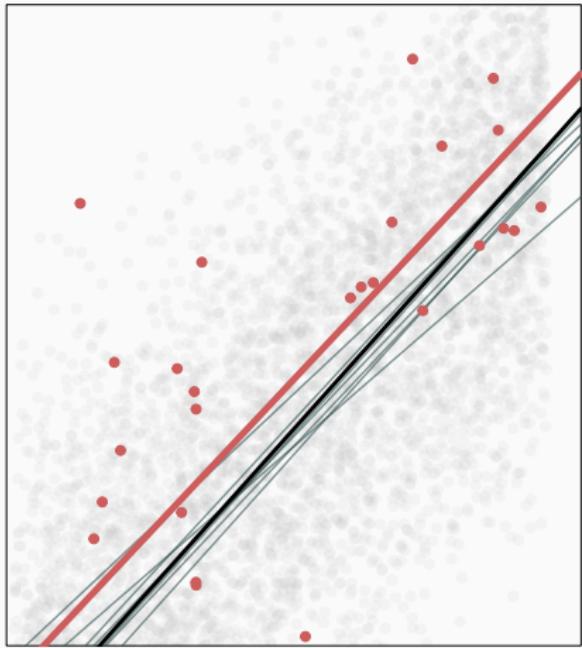


histrogram of beta 1 across 7 samples

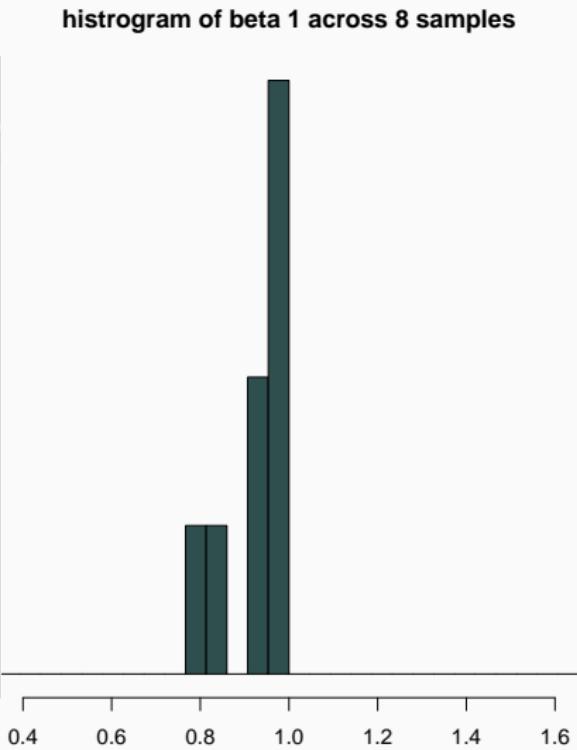


# Sampling distribution of OLS

8 line fits on 8 samples

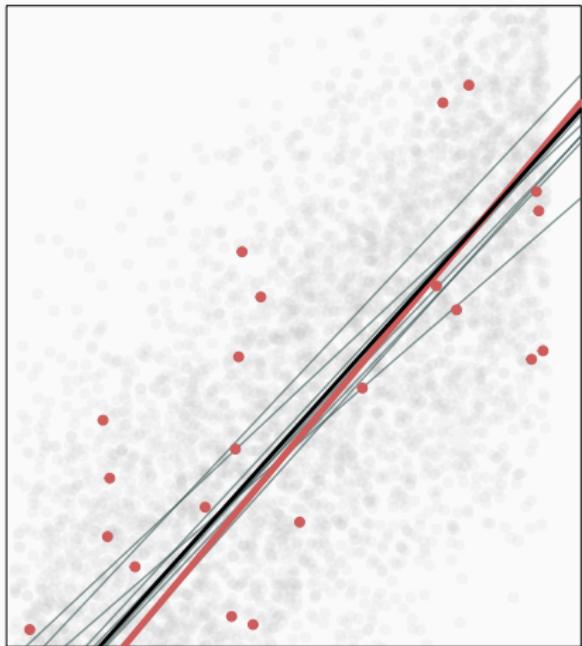


histrogram of beta 1 across 8 samples

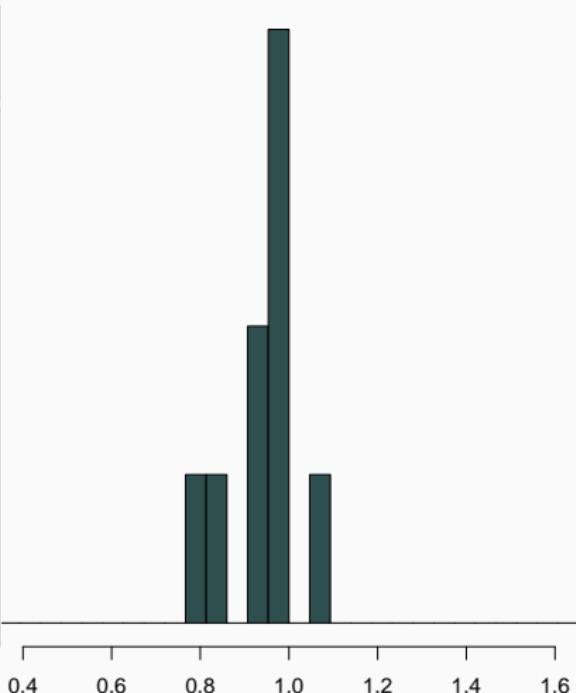


# Sampling distribution of OLS

9 line fits on 9 samples

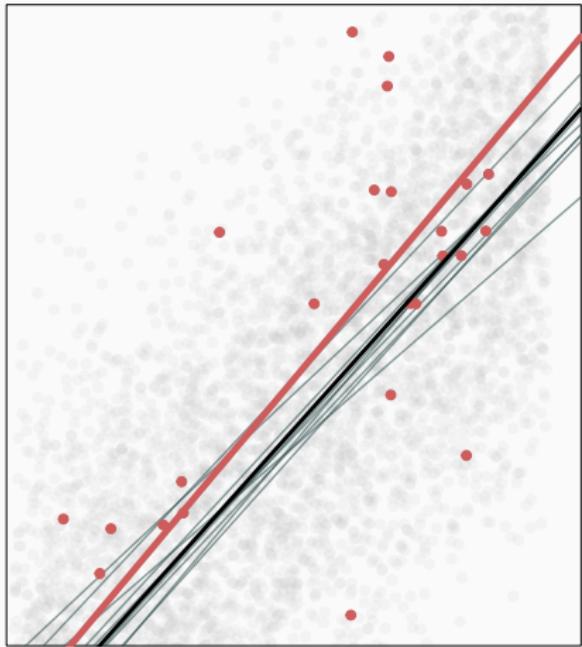


histrogram of beta 1 across 9 samples

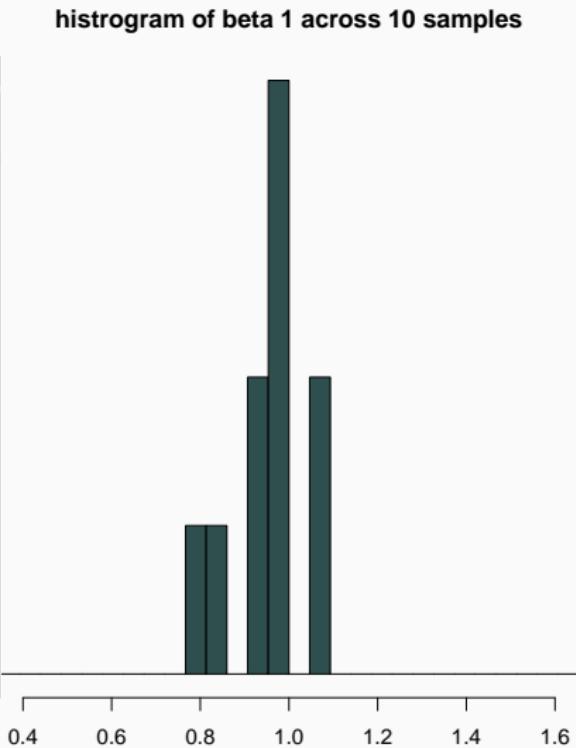


# Sampling distribution of OLS

10 line fits on 10 samples

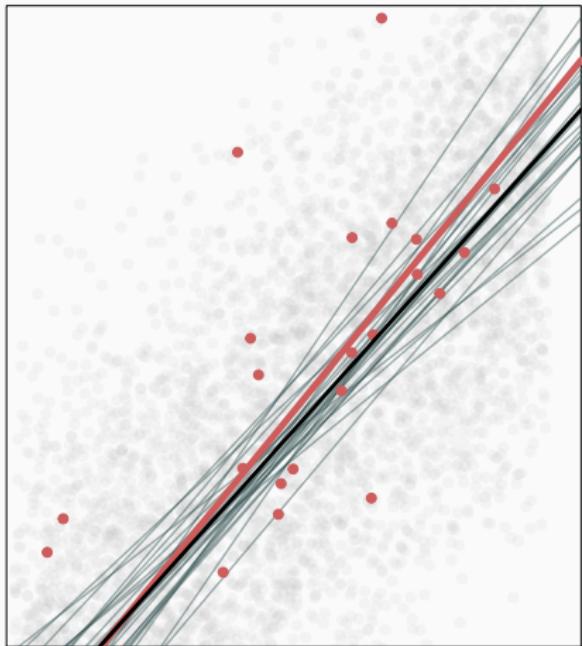


histrogram of beta 1 across 10 samples

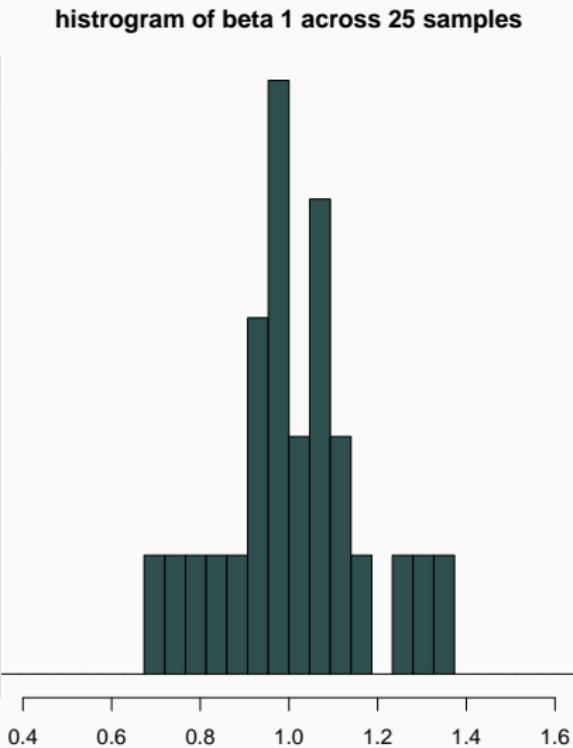


# Sampling distribution of OLS

25 line fits on 25 samples

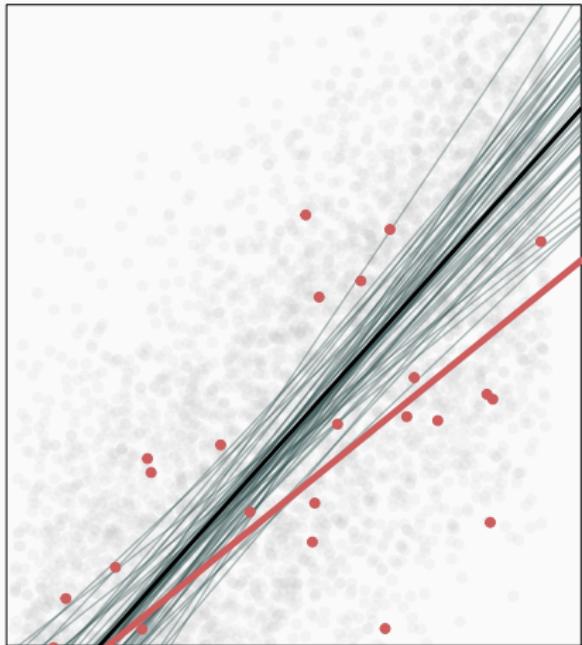


histrogram of beta 1 across 25 samples

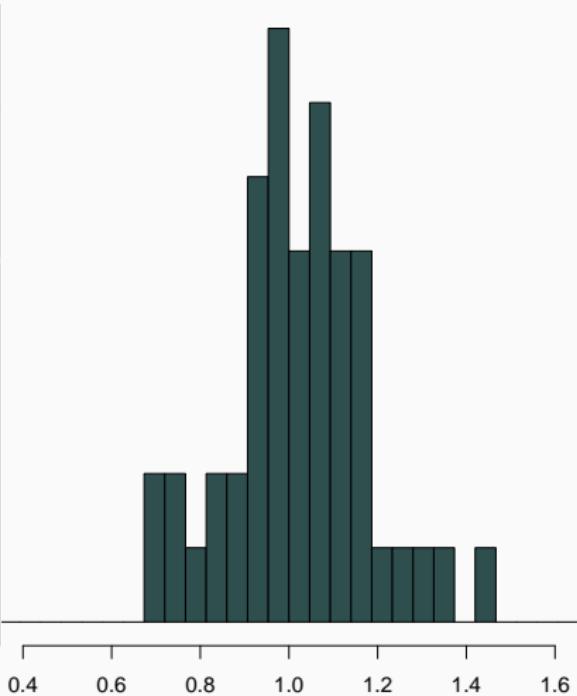


# Sampling distribution of OLS

50 line fits on 50 samples

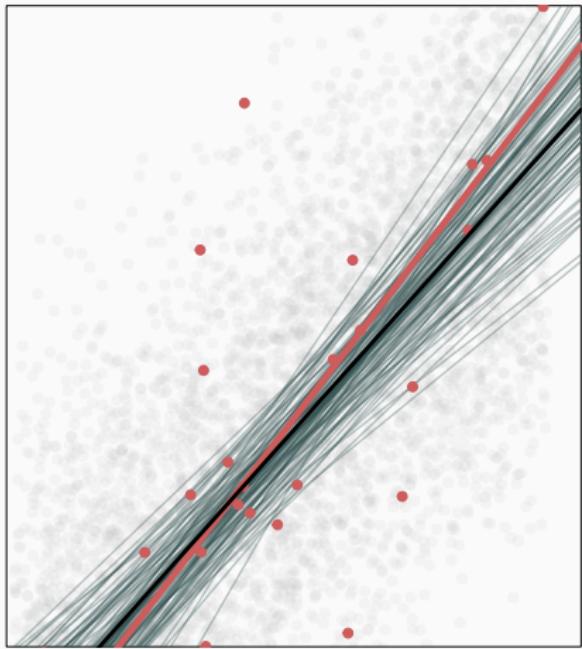


histrogram of beta 1 across 50 samples

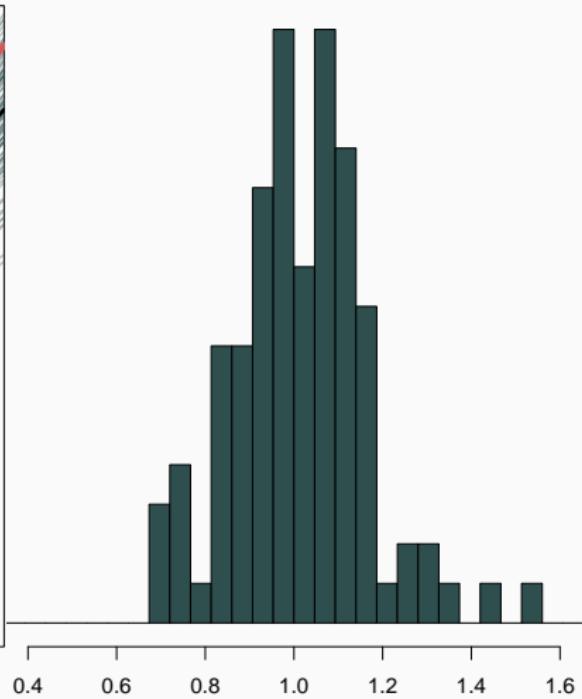


# Sampling distribution of OLS

100 line fits on 100 samples

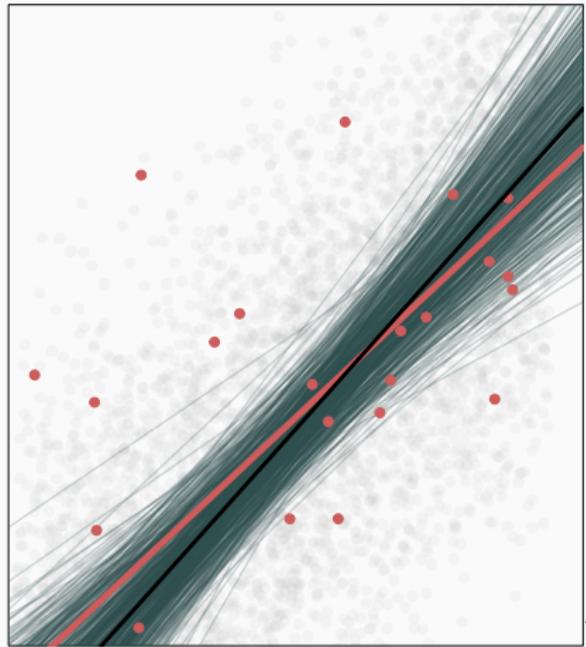


histrogram of beta 1 across 100 samples

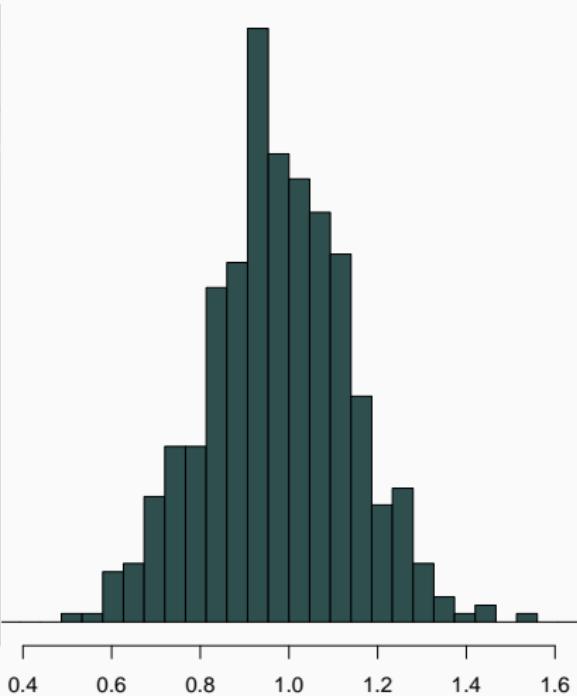


# Sampling distribution of OLS

500 line fits on 500 samples

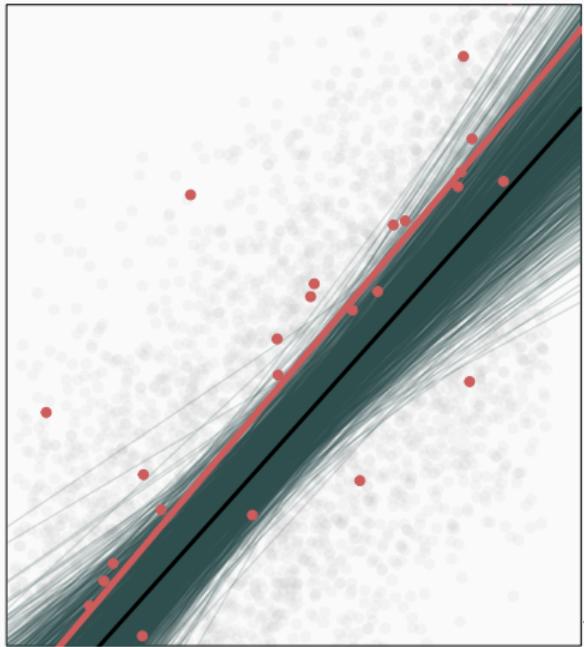


histrogram of beta 1 across 500 samples

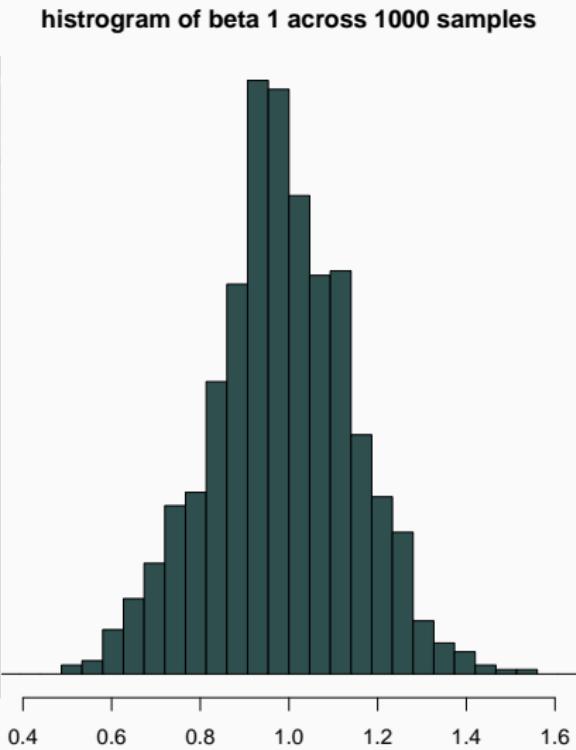


# Sampling distribution of OLS

1000 line fits on 1000 samples

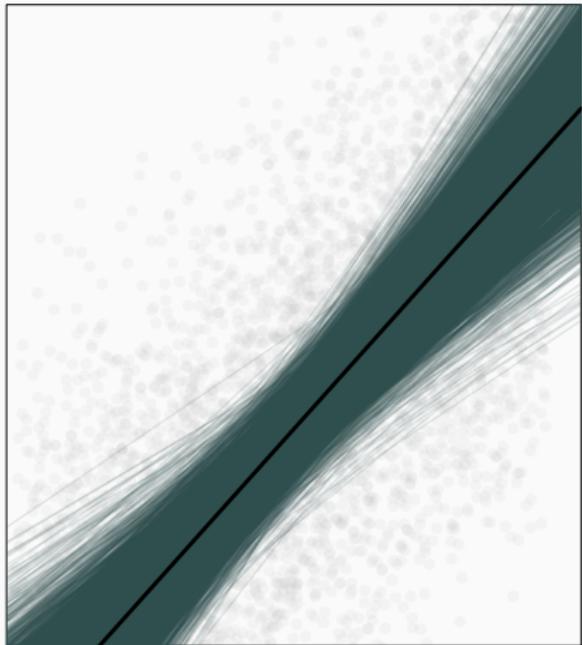


histrogram of beta 1 across 1000 samples

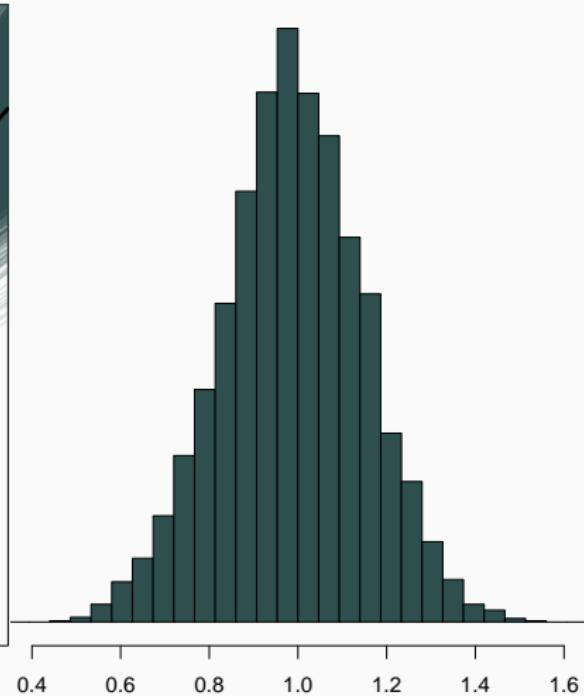


# Sampling distribution of OLS

4000 line fits on 4000 samples



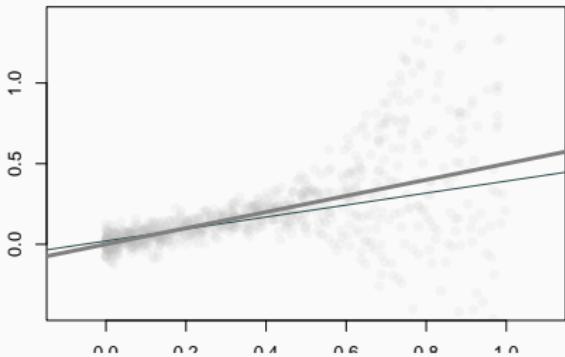
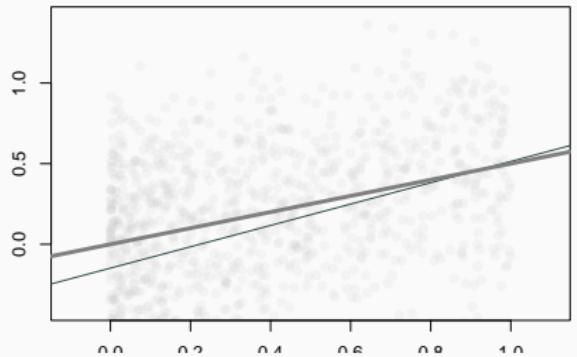
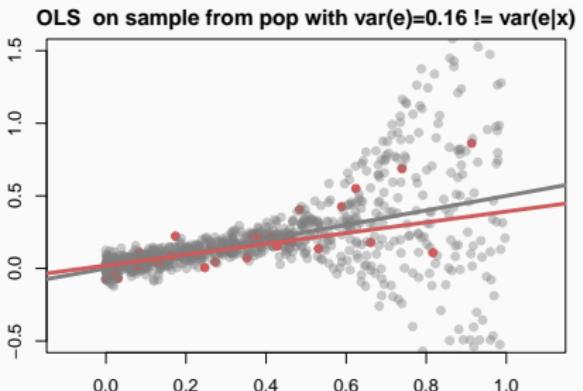
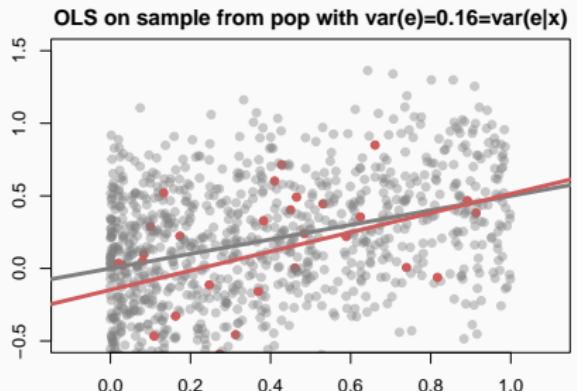
histrogram of beta 1 across 4000 samples



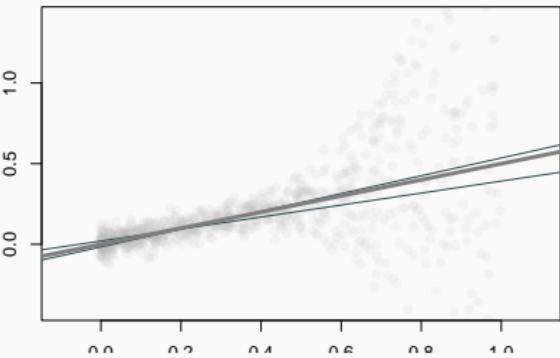
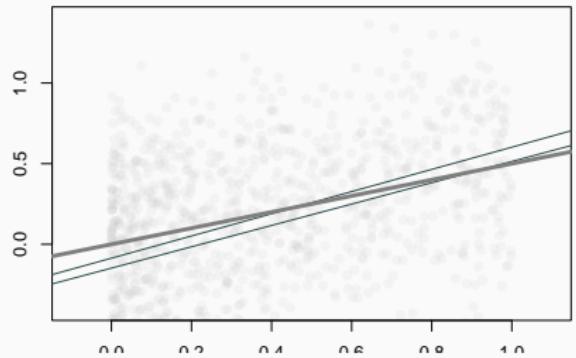
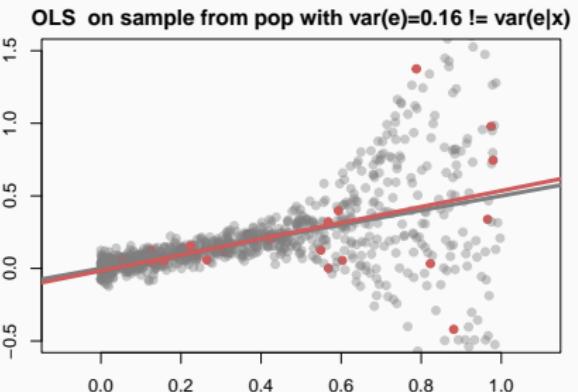
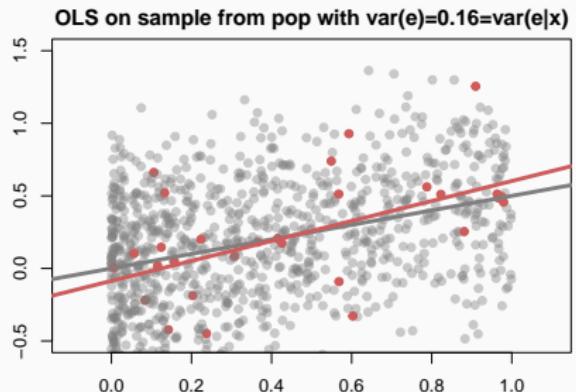
## **Sampling distribution of OLS under heteroskedasticity**

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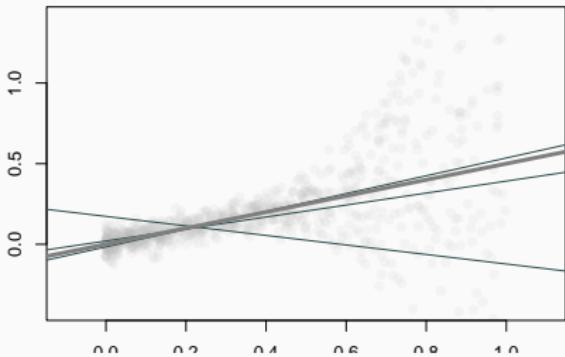
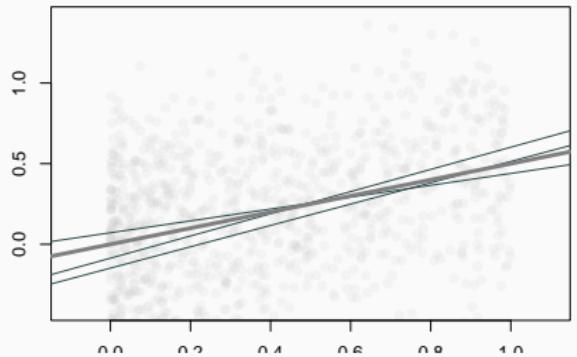
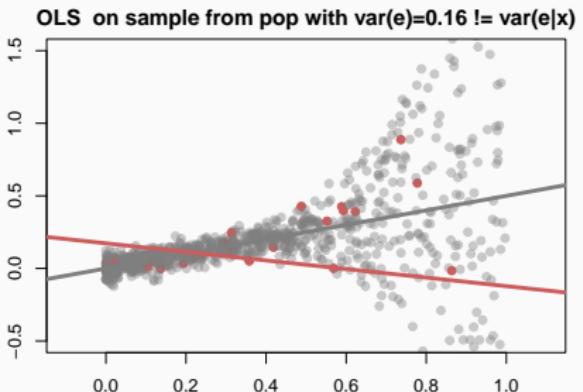
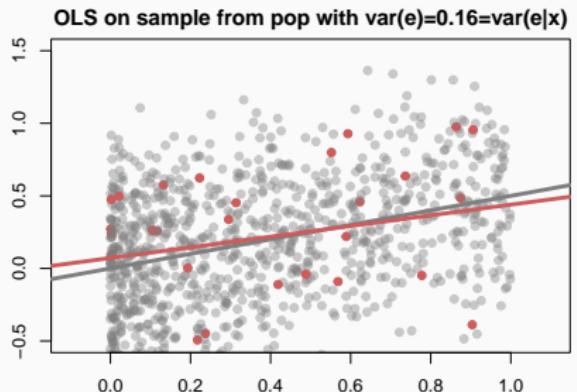
# Sampling distribution of OLS under heteroskedasticity



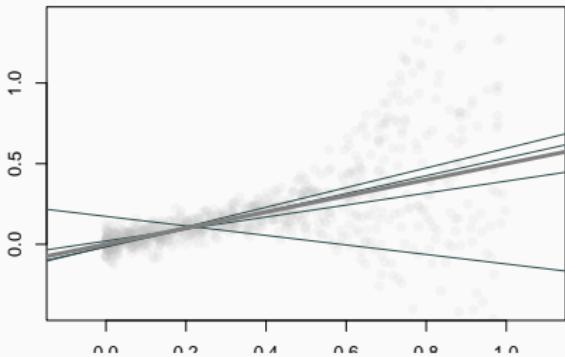
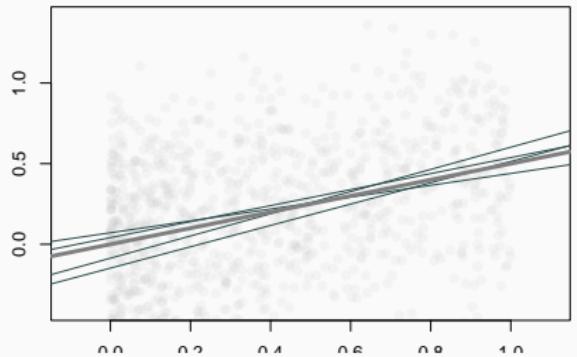
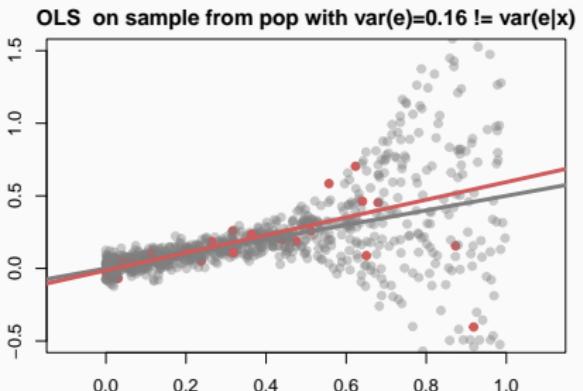
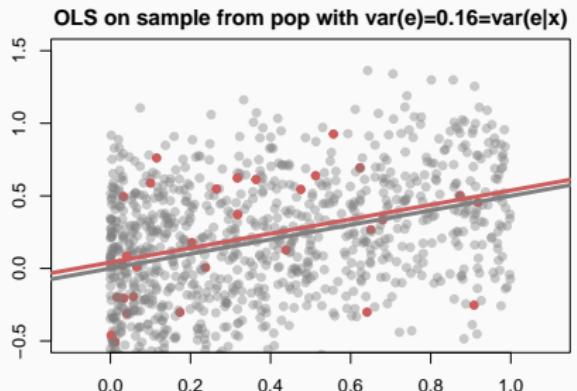
# Sampling distribution of OLS under heteroskedasticity



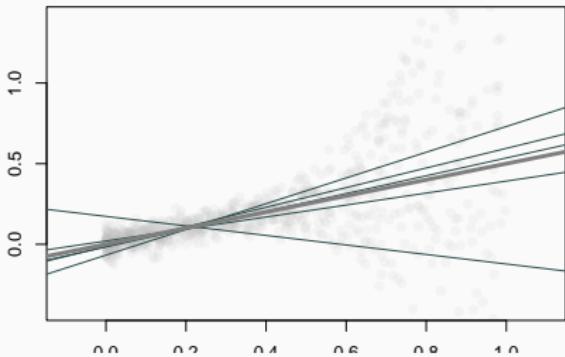
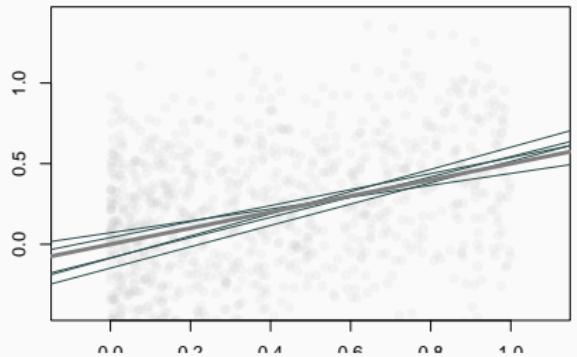
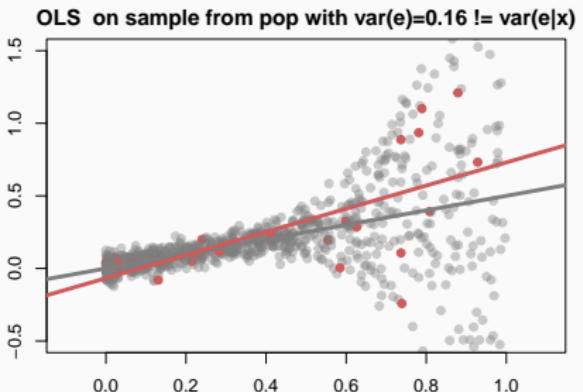
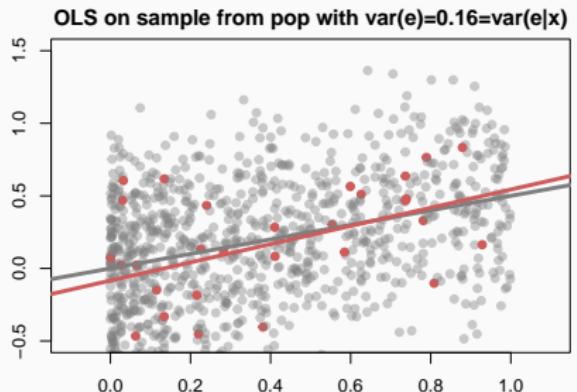
# Sampling distribution of OLS under heteroskedasticity



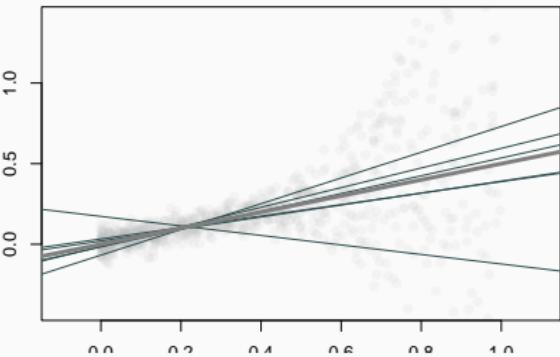
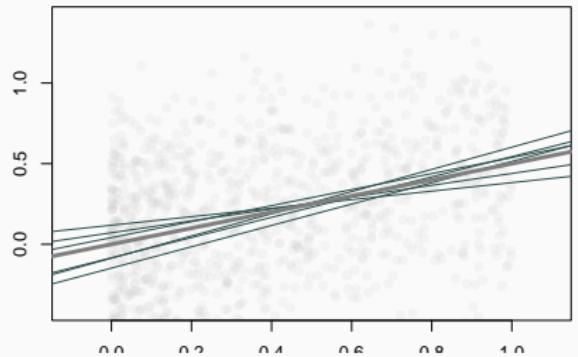
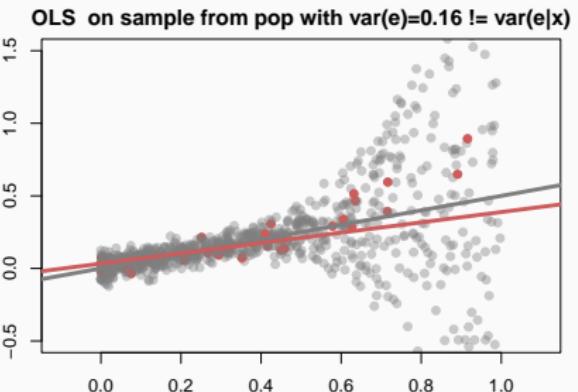
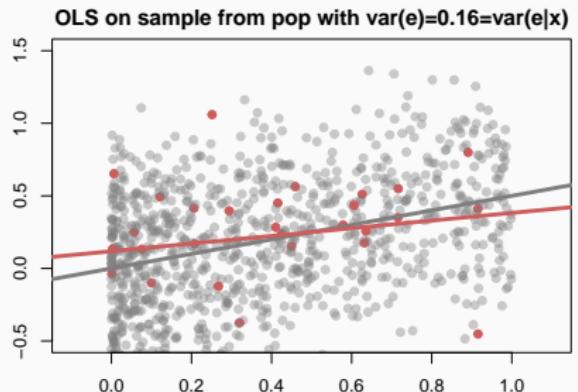
# Sampling distribution of OLS under heteroskedasticity



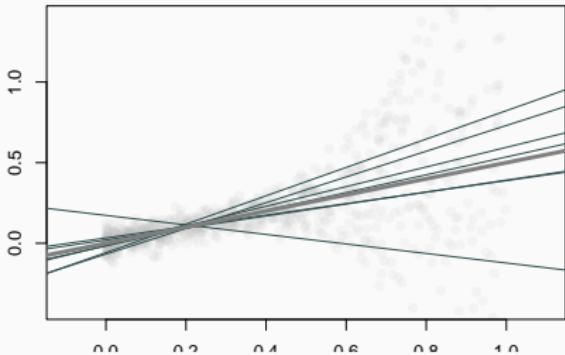
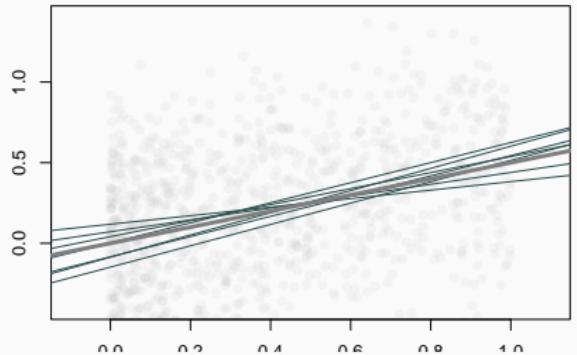
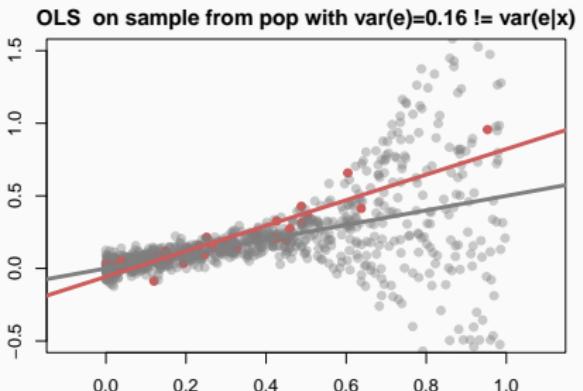
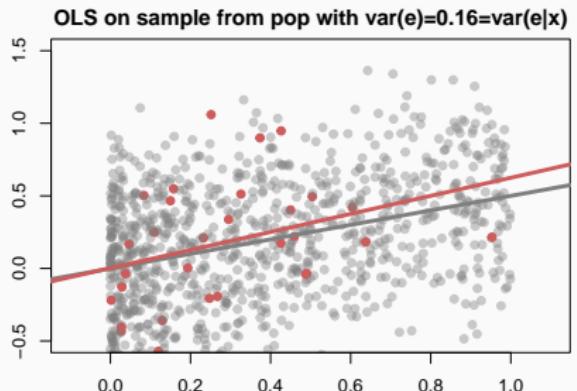
# Sampling distribution of OLS under heteroskedasticity



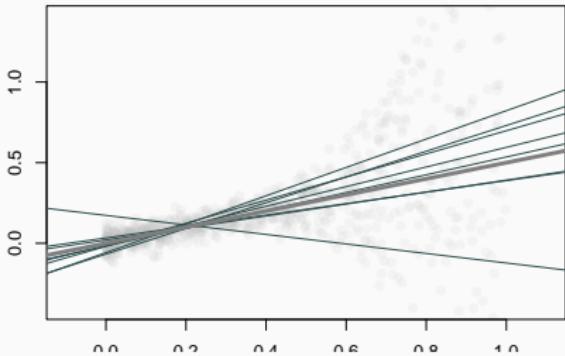
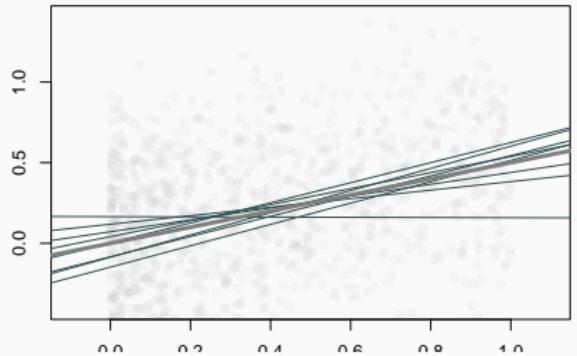
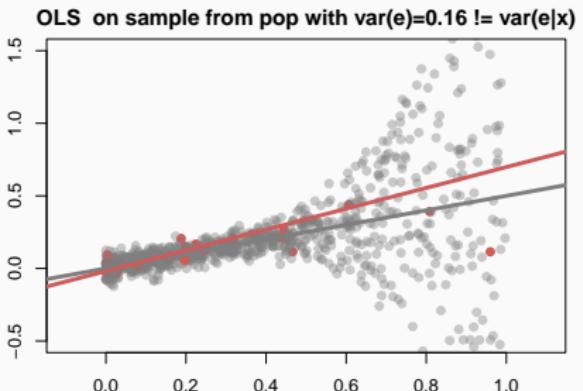
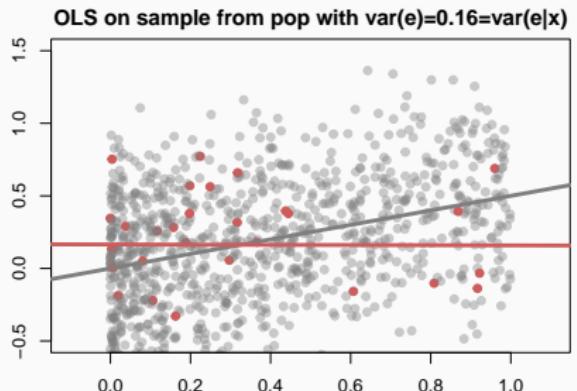
# Sampling distribution of OLS under heteroskedasticity



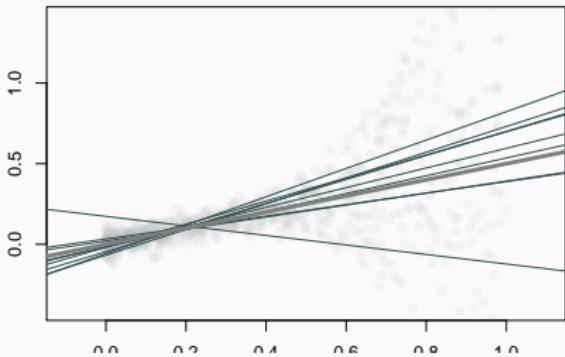
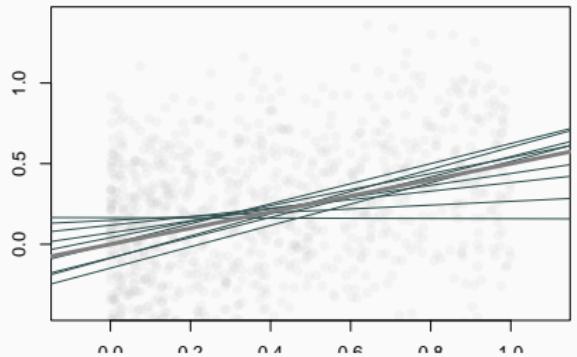
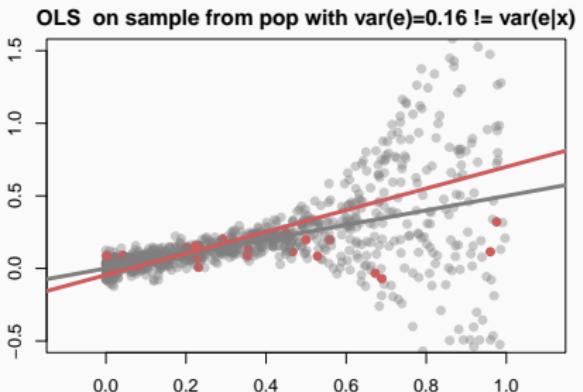
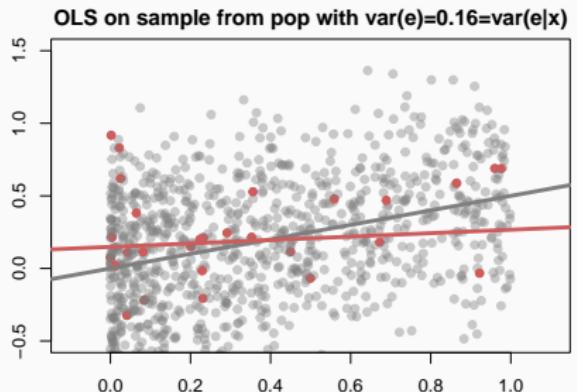
# Sampling distribution of OLS under heteroskedasticity



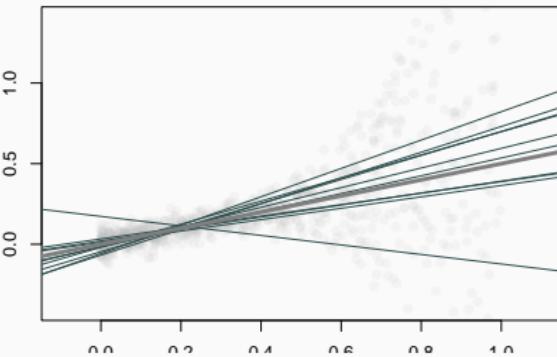
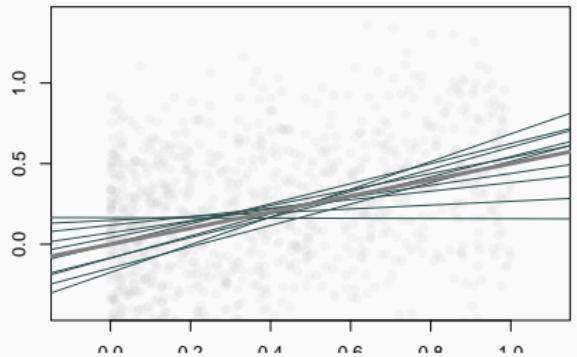
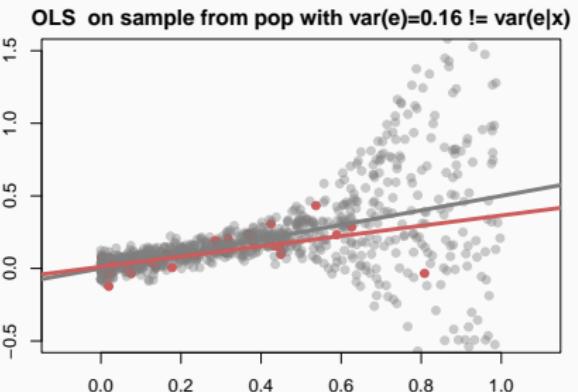
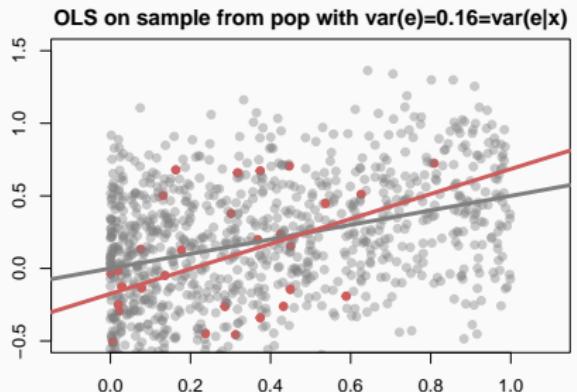
# Sampling distribution of OLS under heteroskedasticity



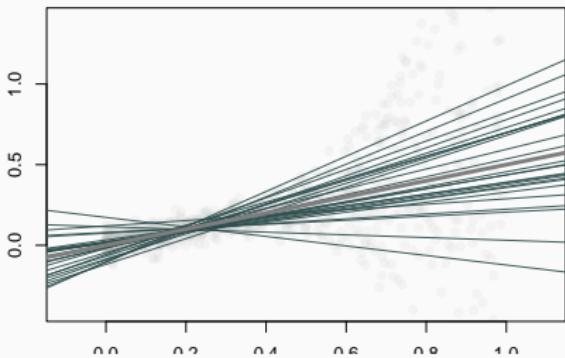
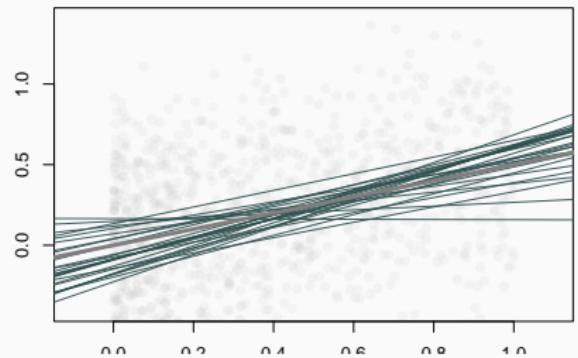
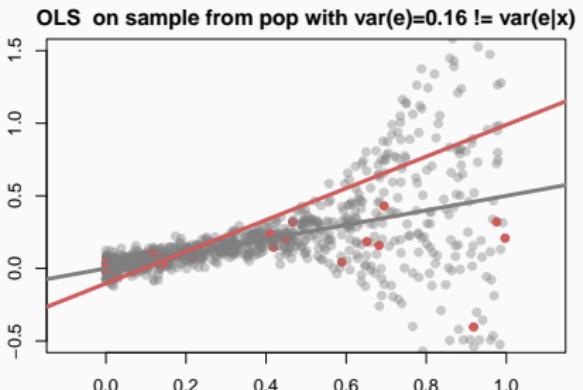
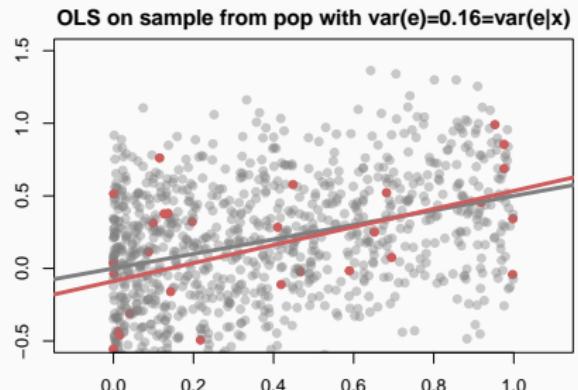
# Sampling distribution of OLS under heteroskedasticity



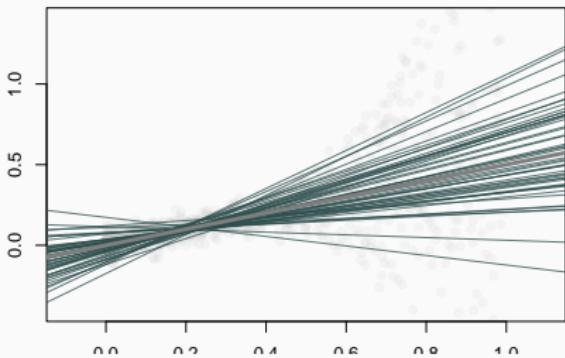
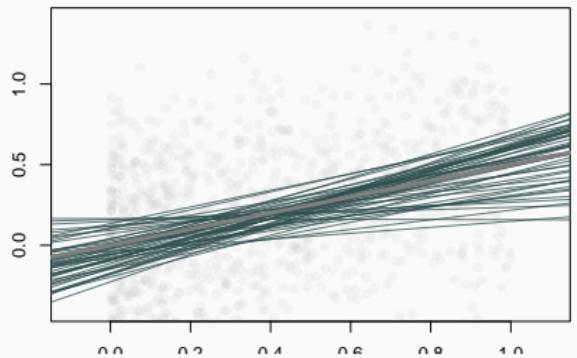
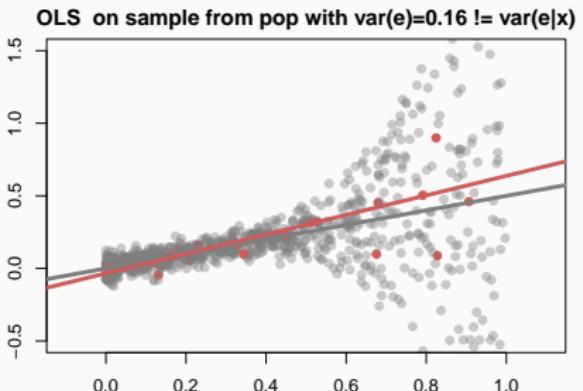
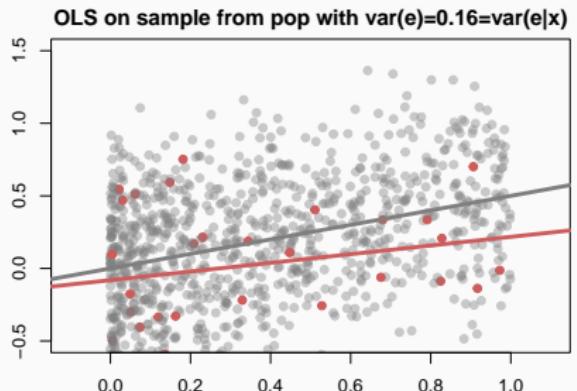
# Sampling distribution of OLS under heteroskedasticity



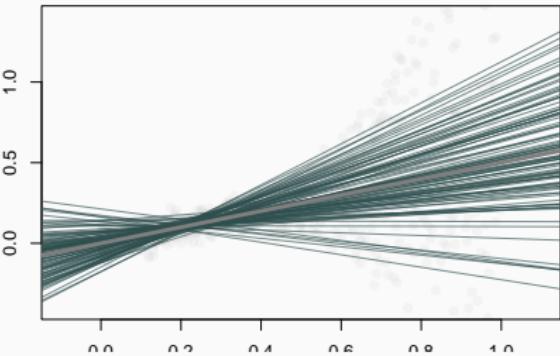
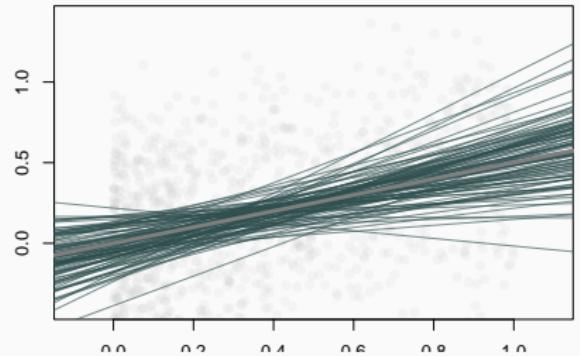
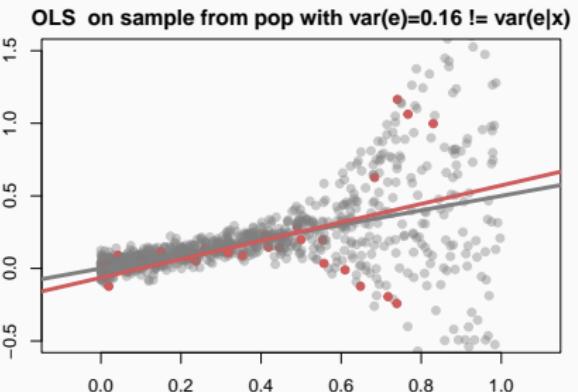
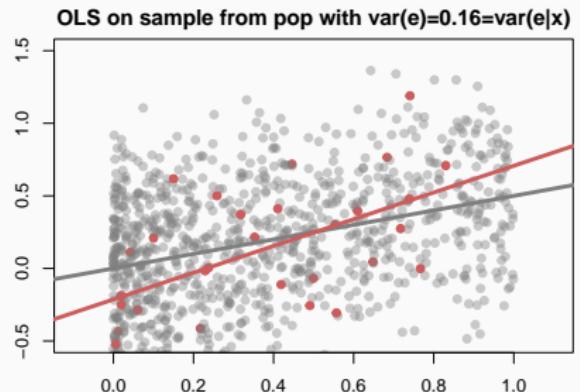
# Sampling distribution of OLS under heteroskedasticity



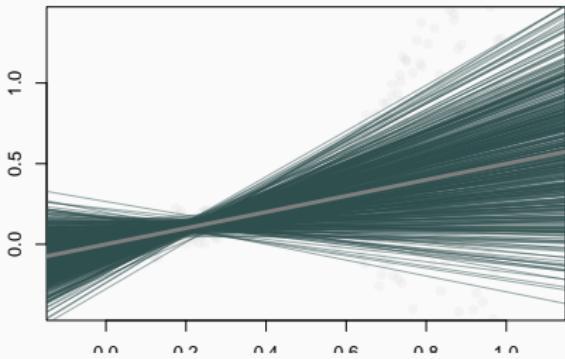
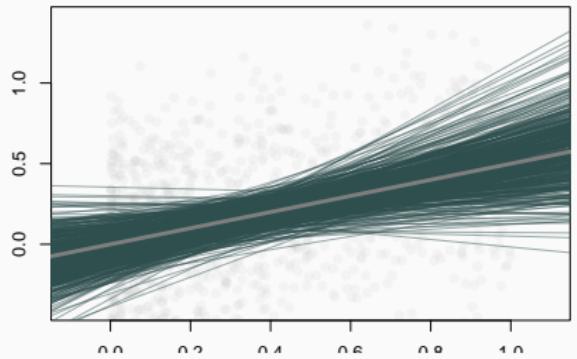
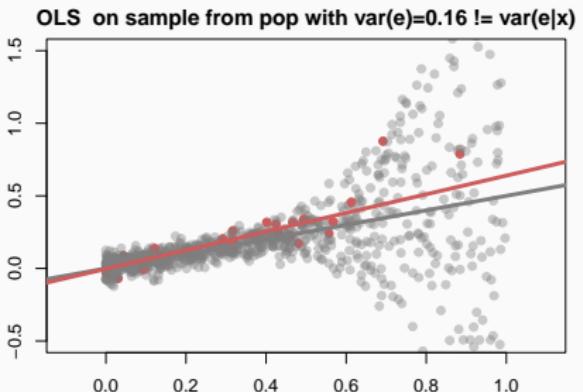
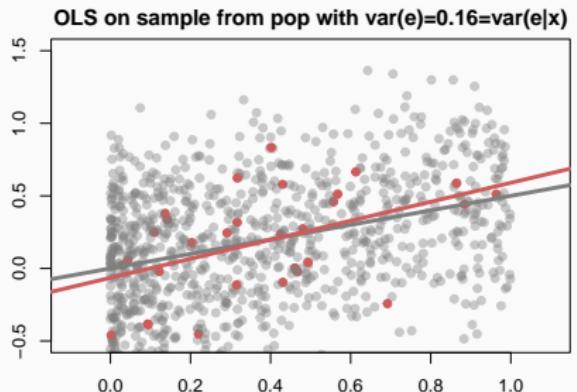
# Sampling distribution of OLS under heteroskedasticity



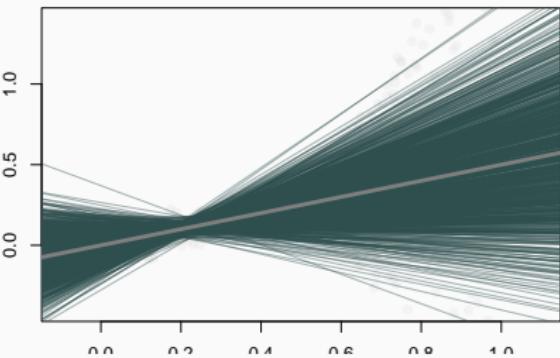
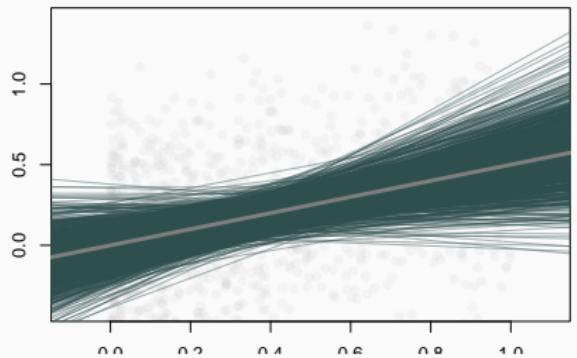
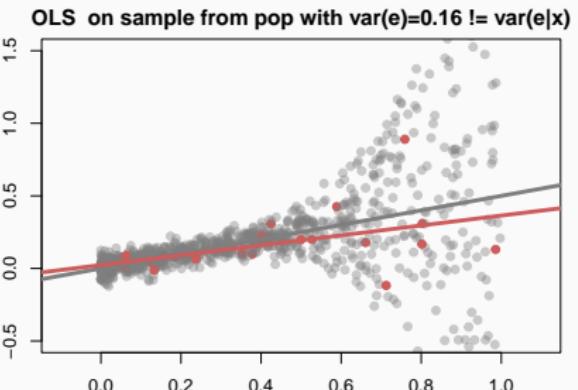
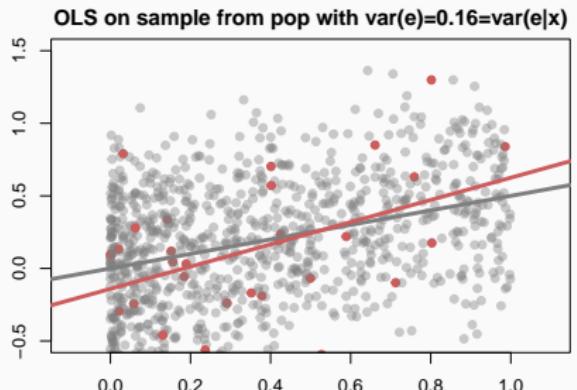
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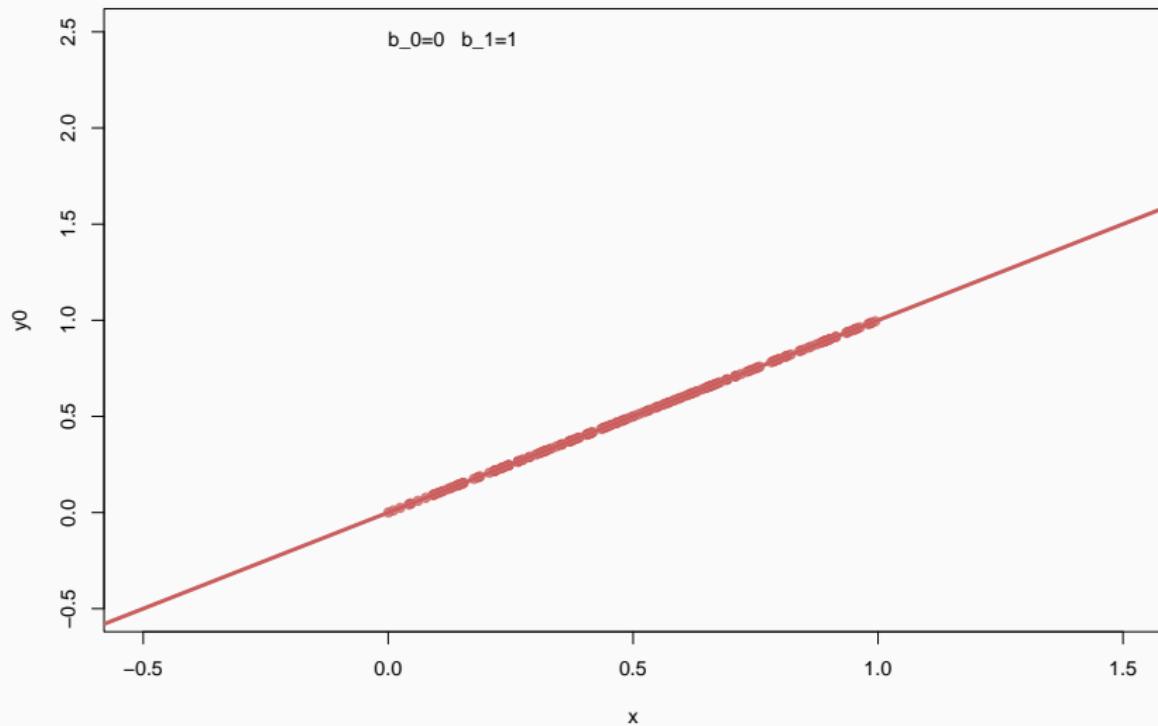
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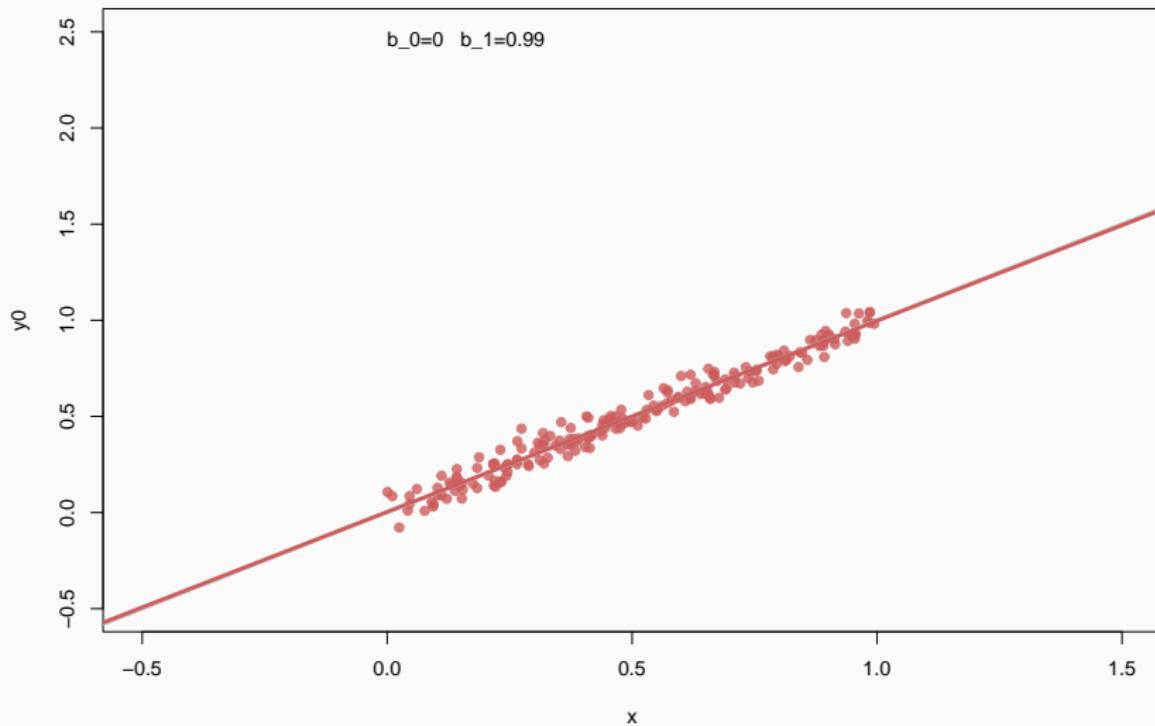
## **Measurement error**

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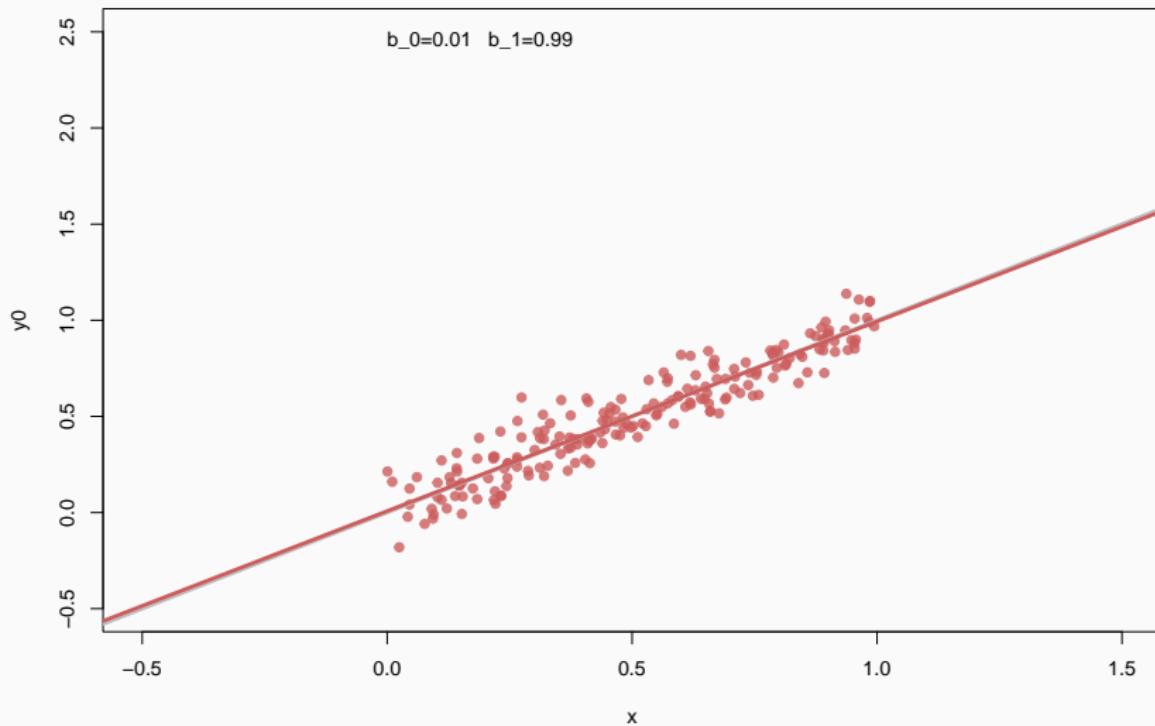
## Measurement error in $y$



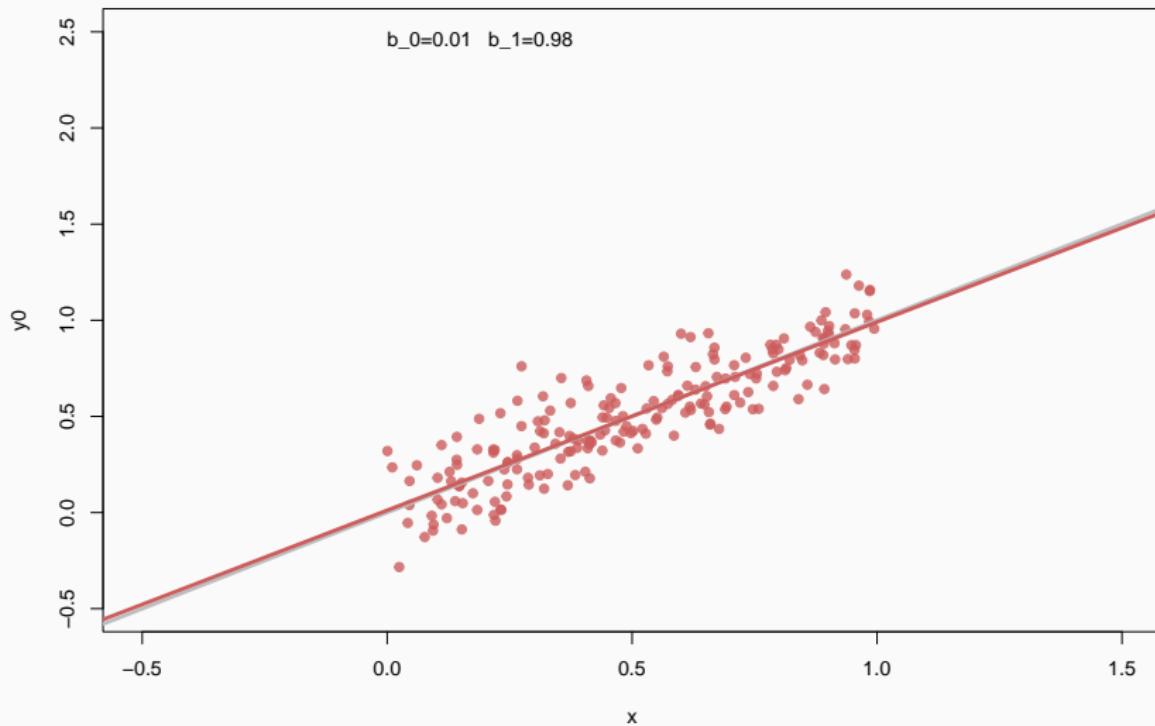
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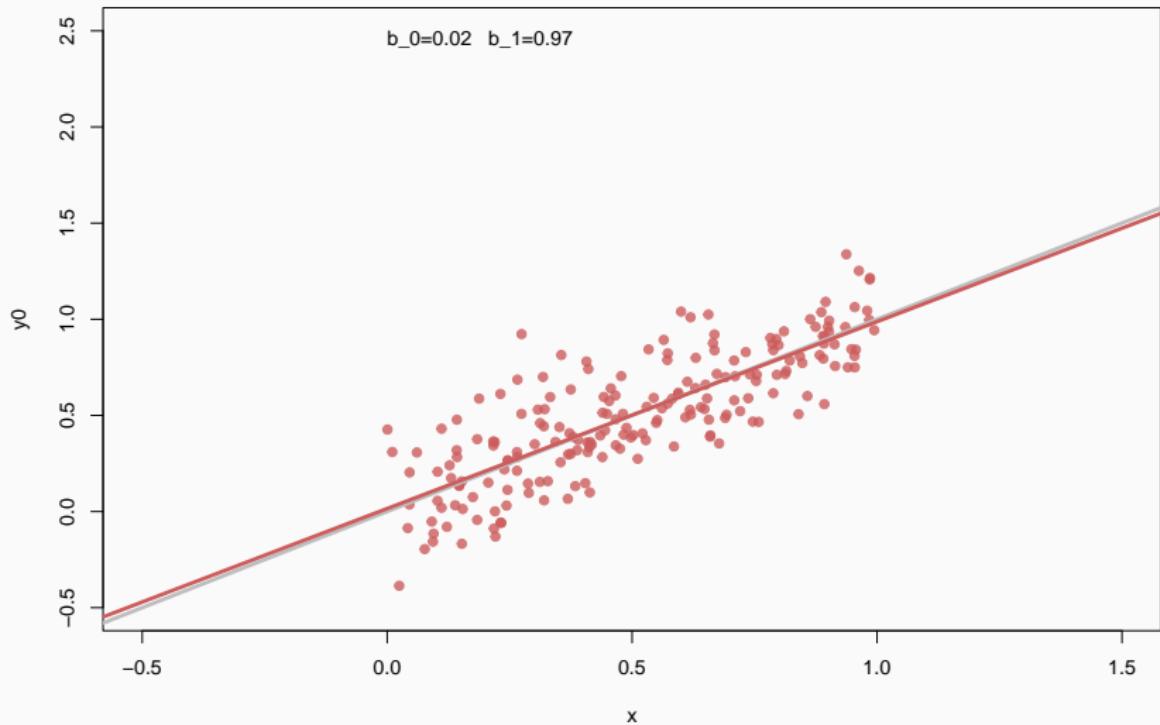
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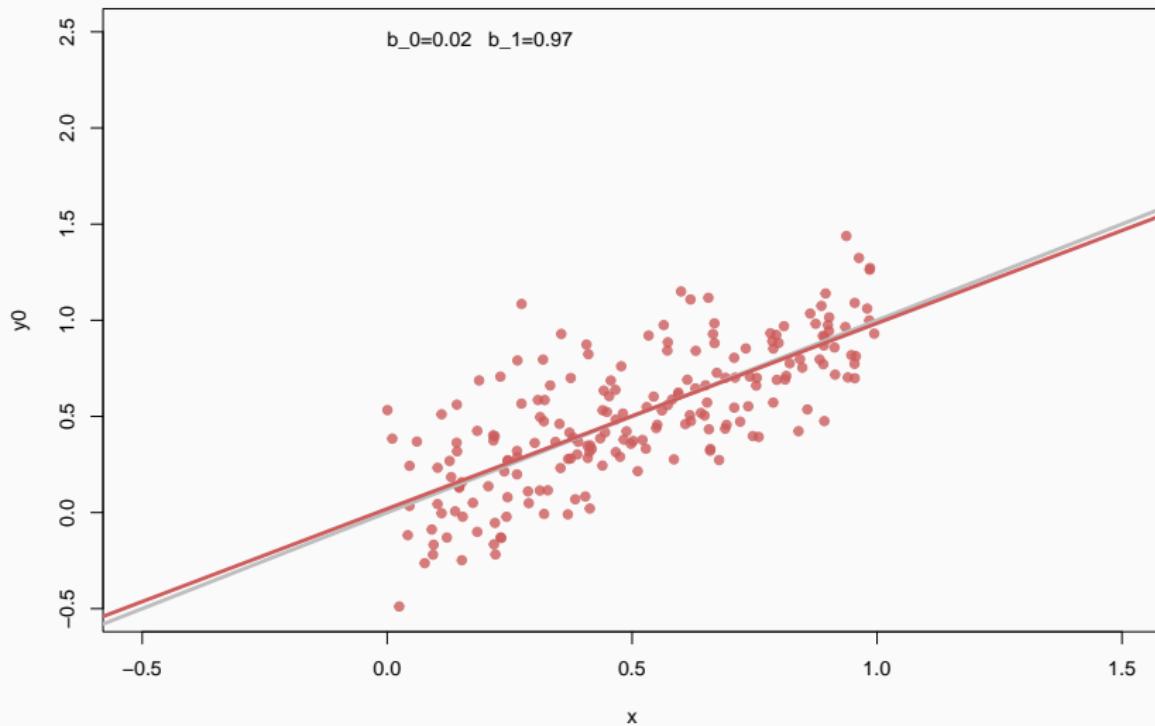
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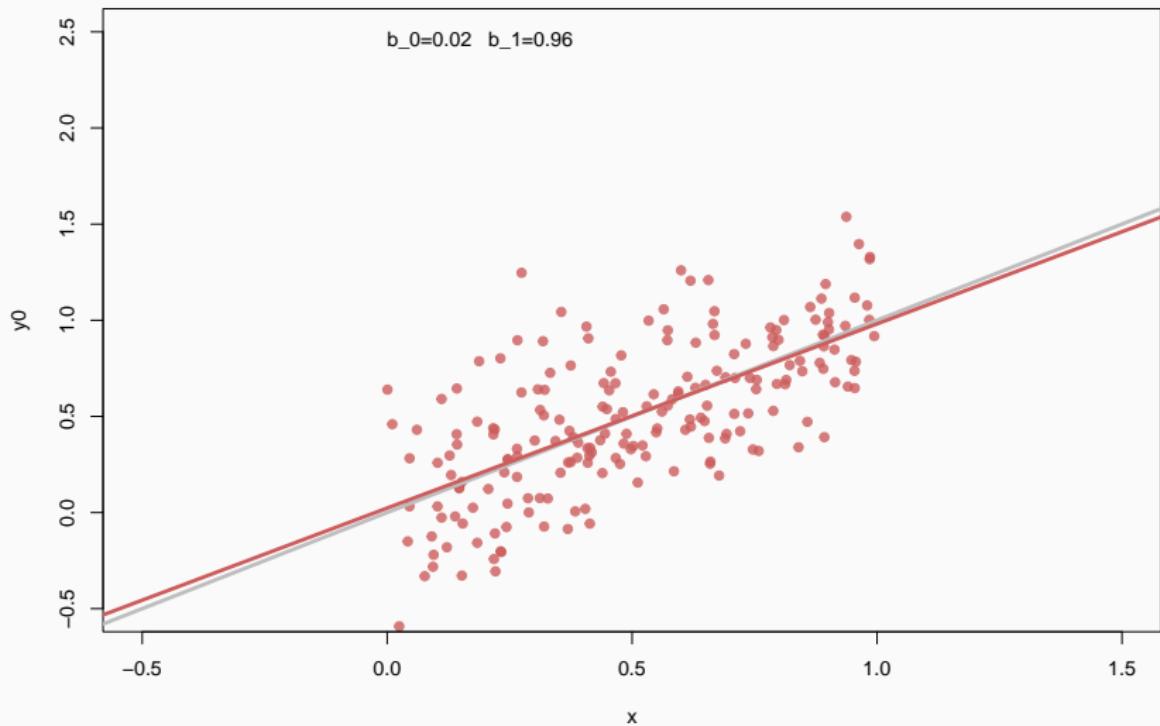
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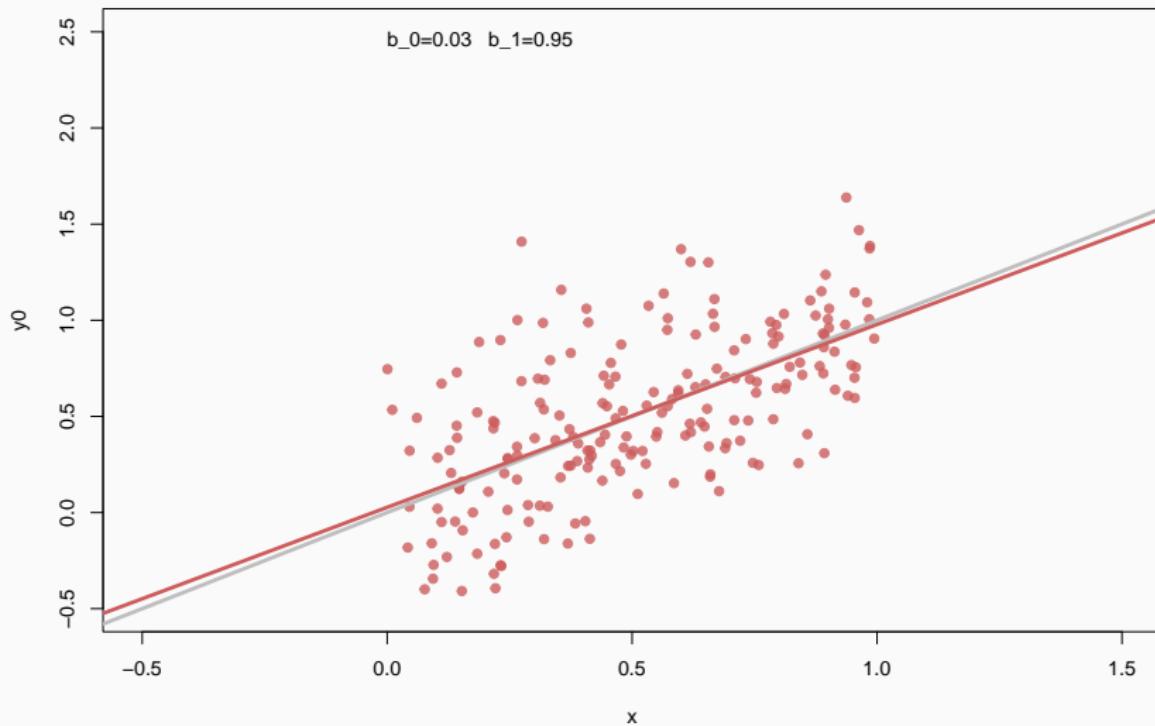
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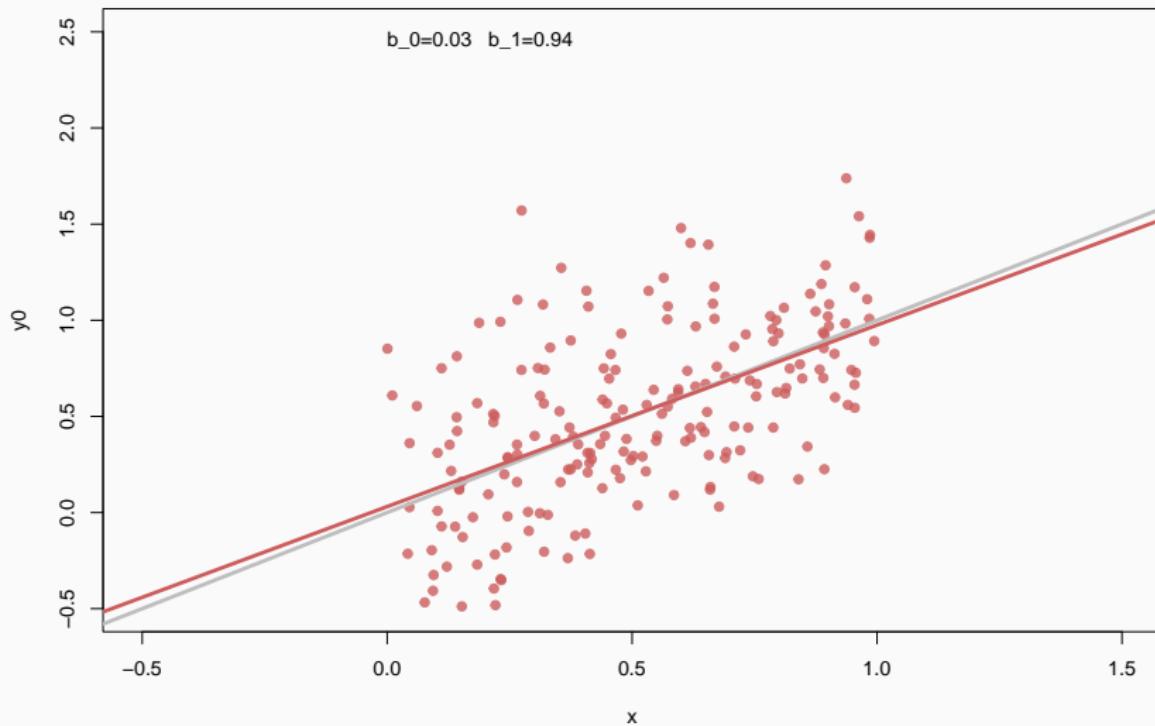
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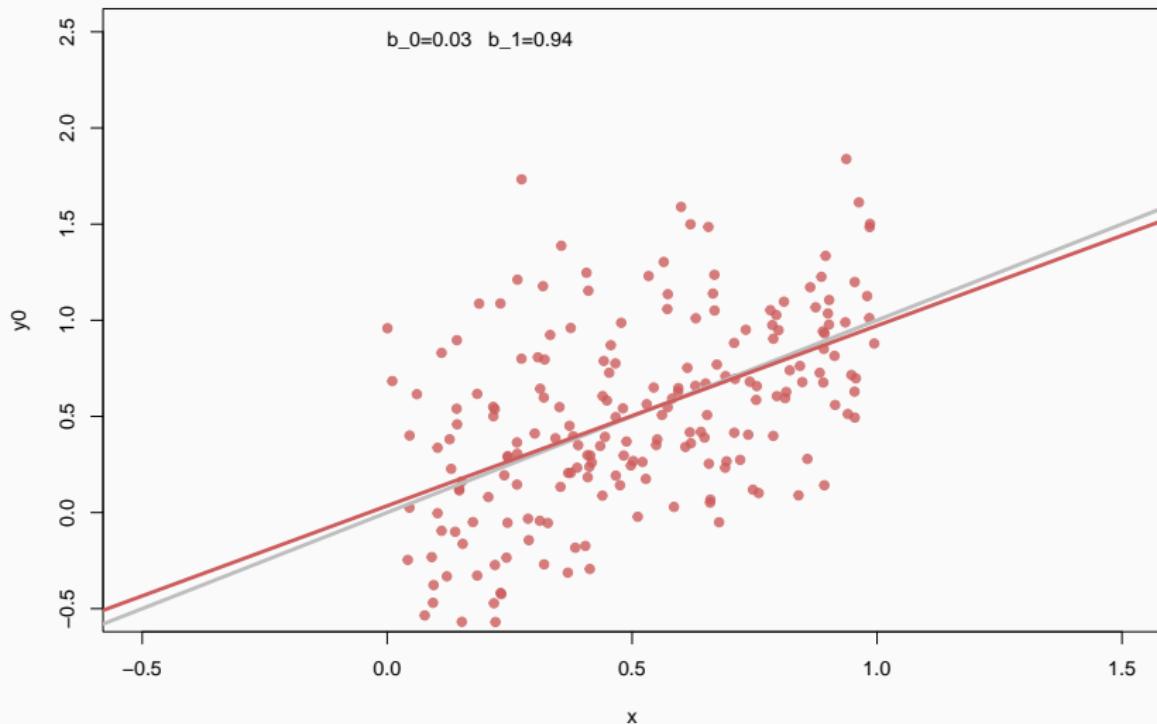
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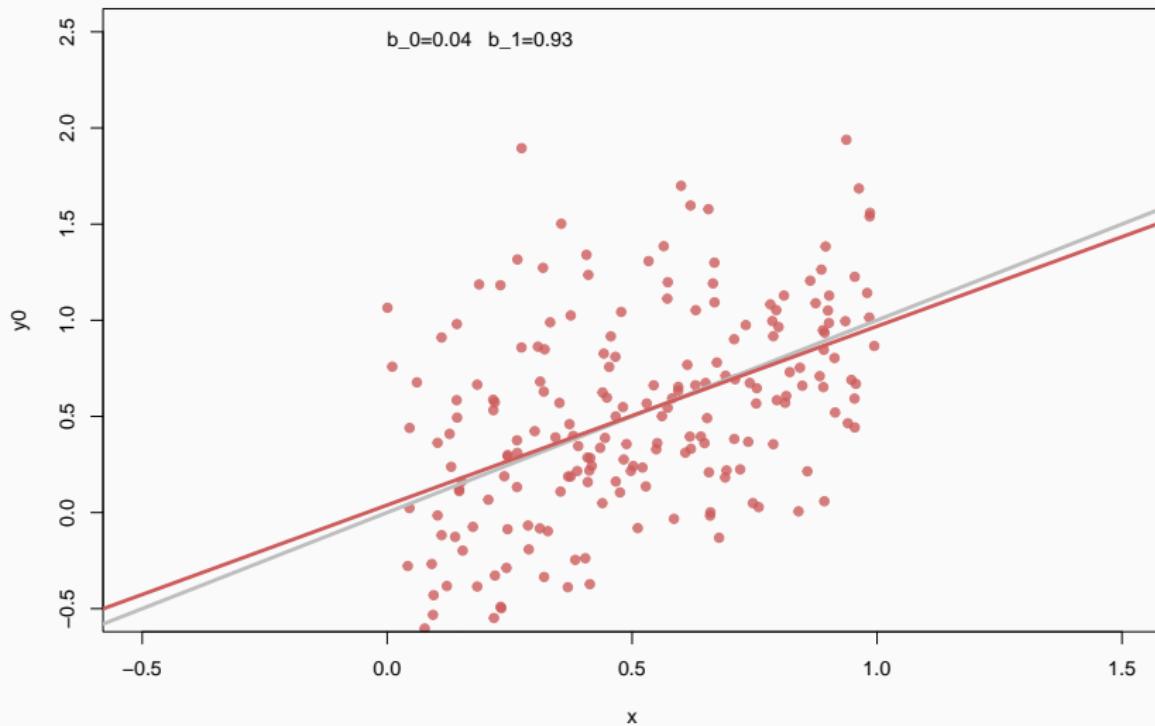
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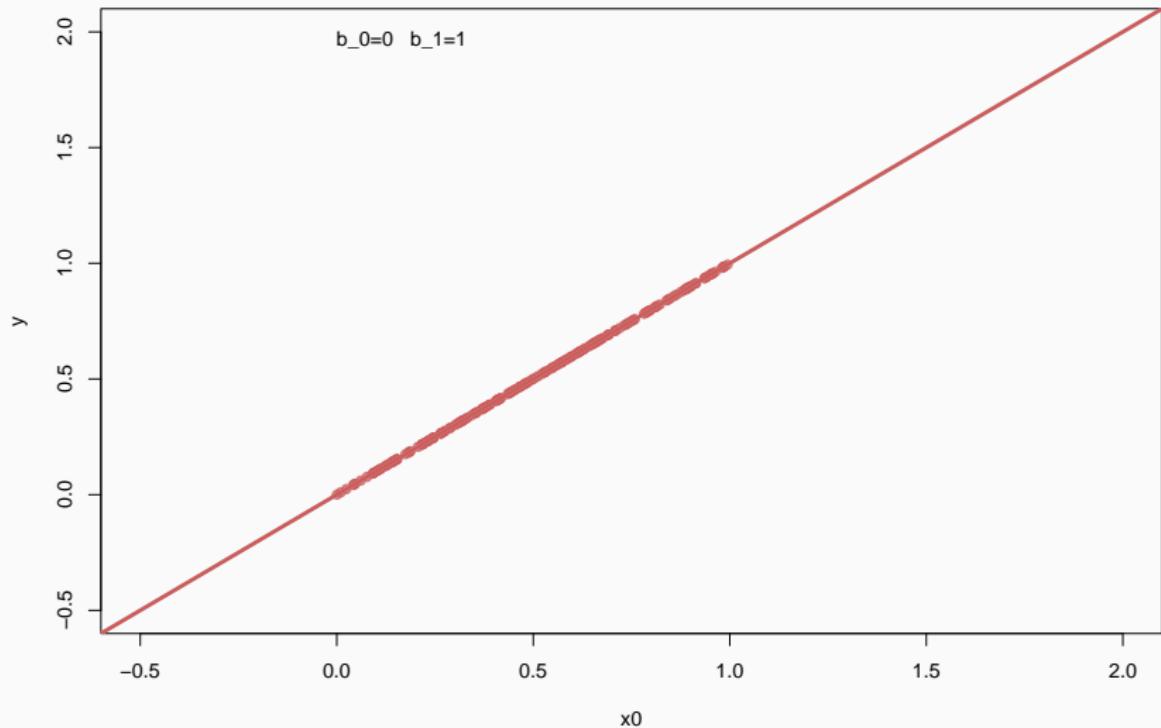
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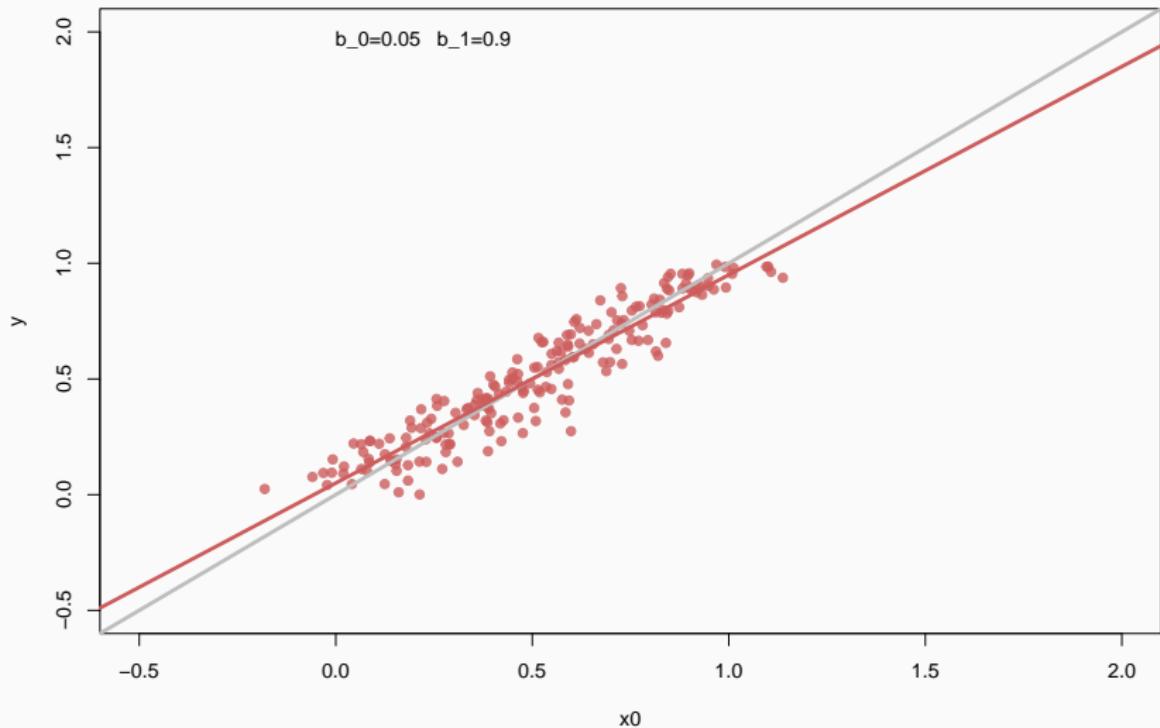
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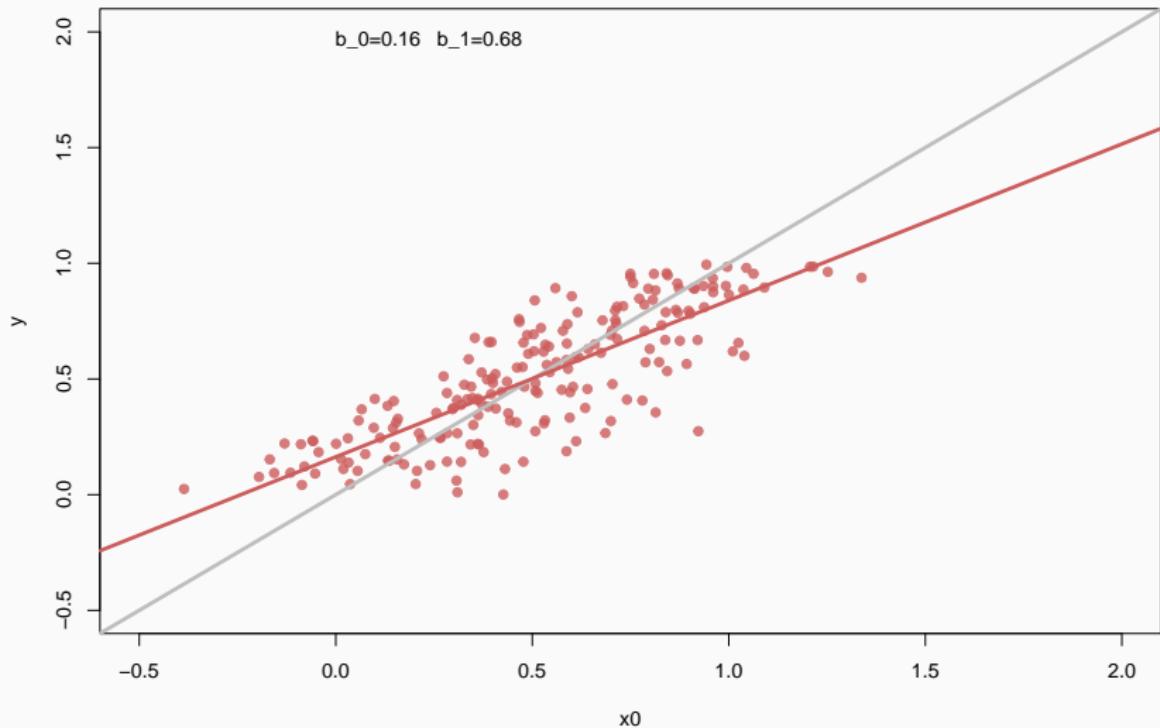
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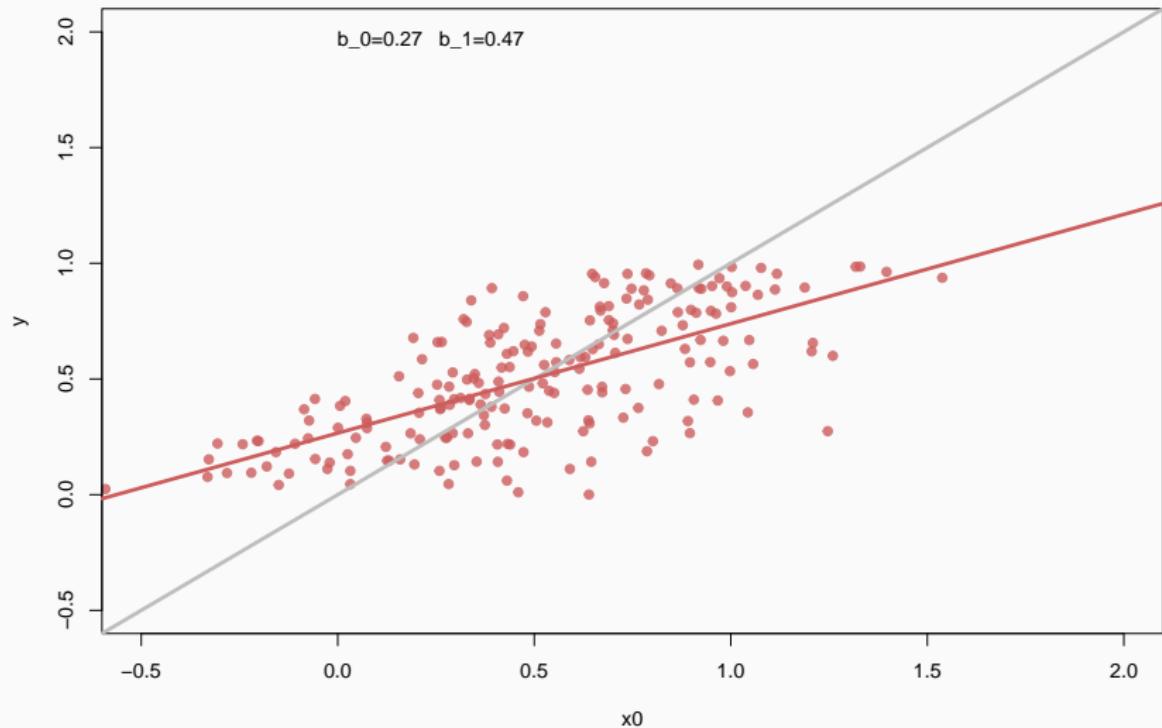
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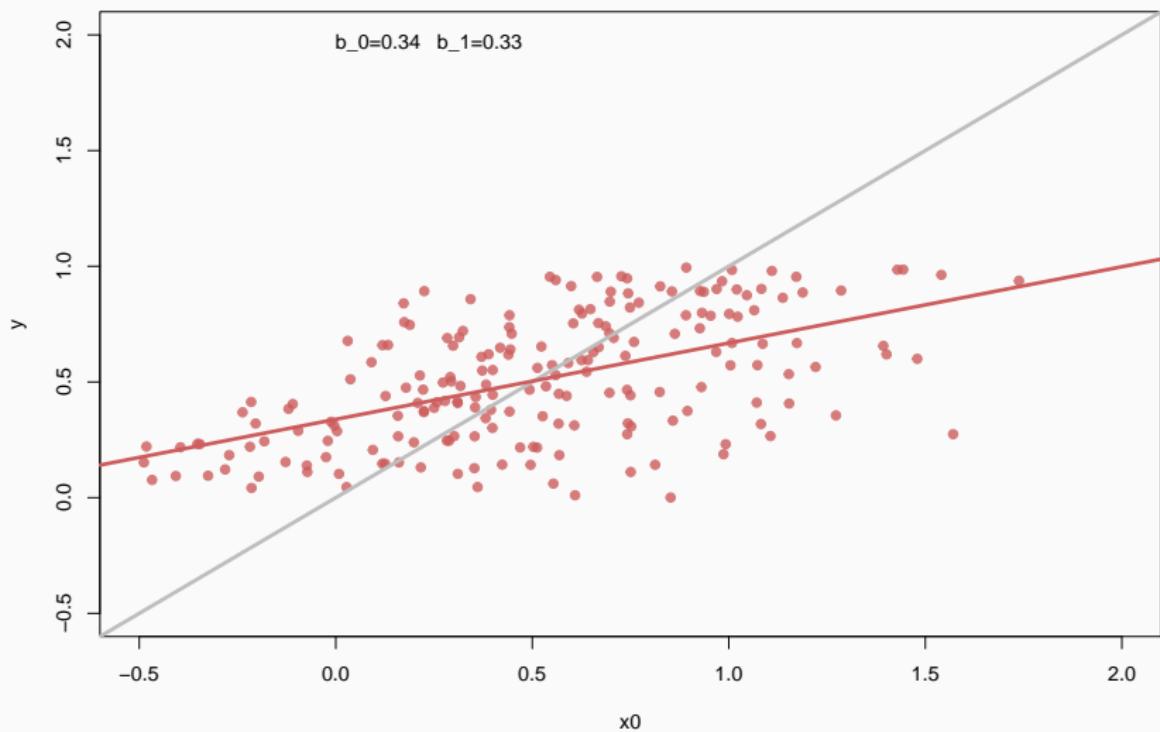
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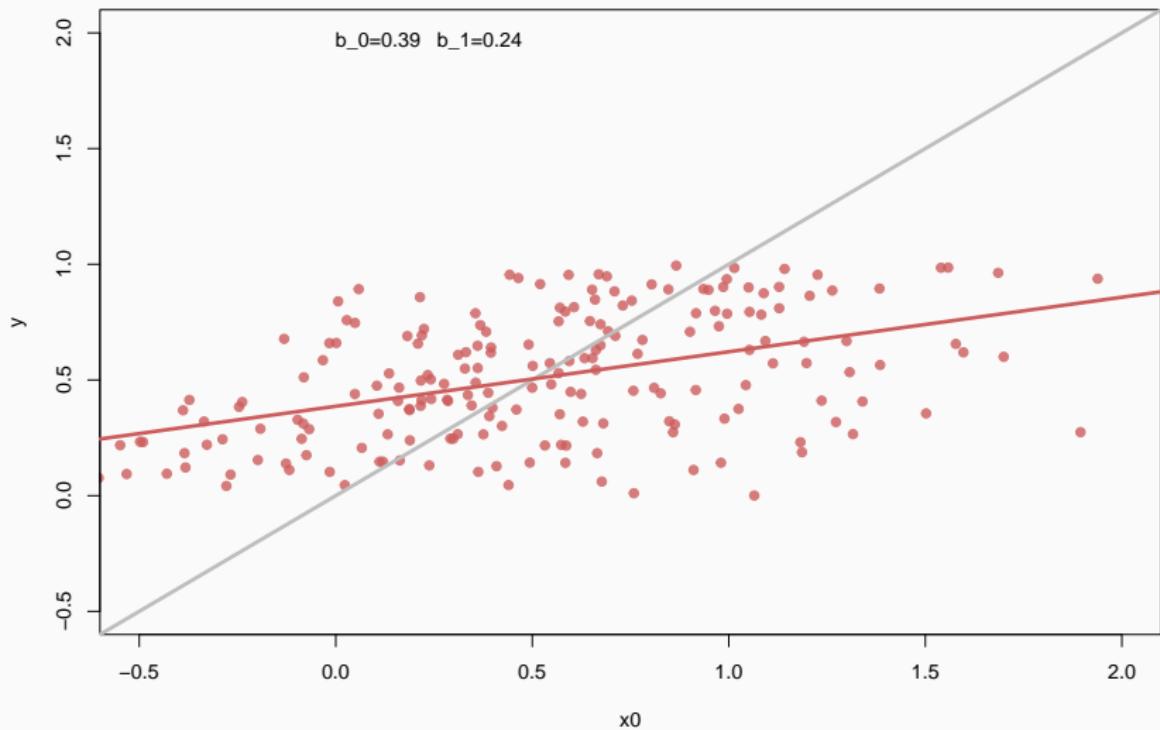
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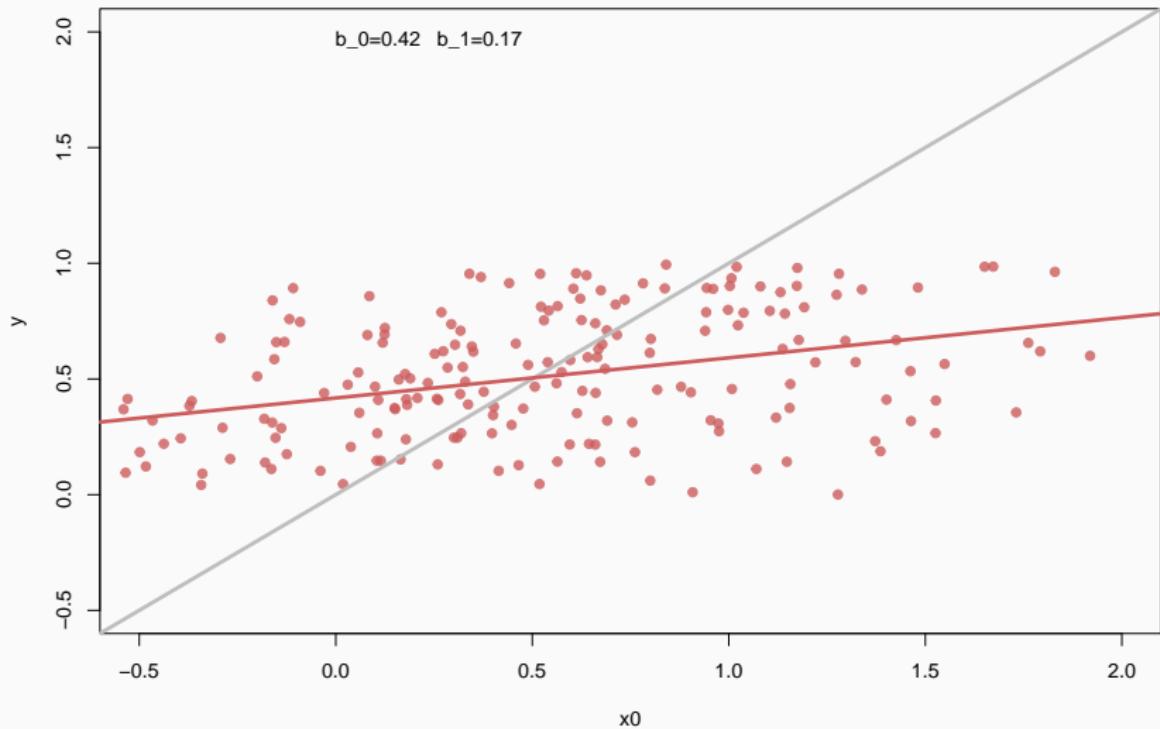
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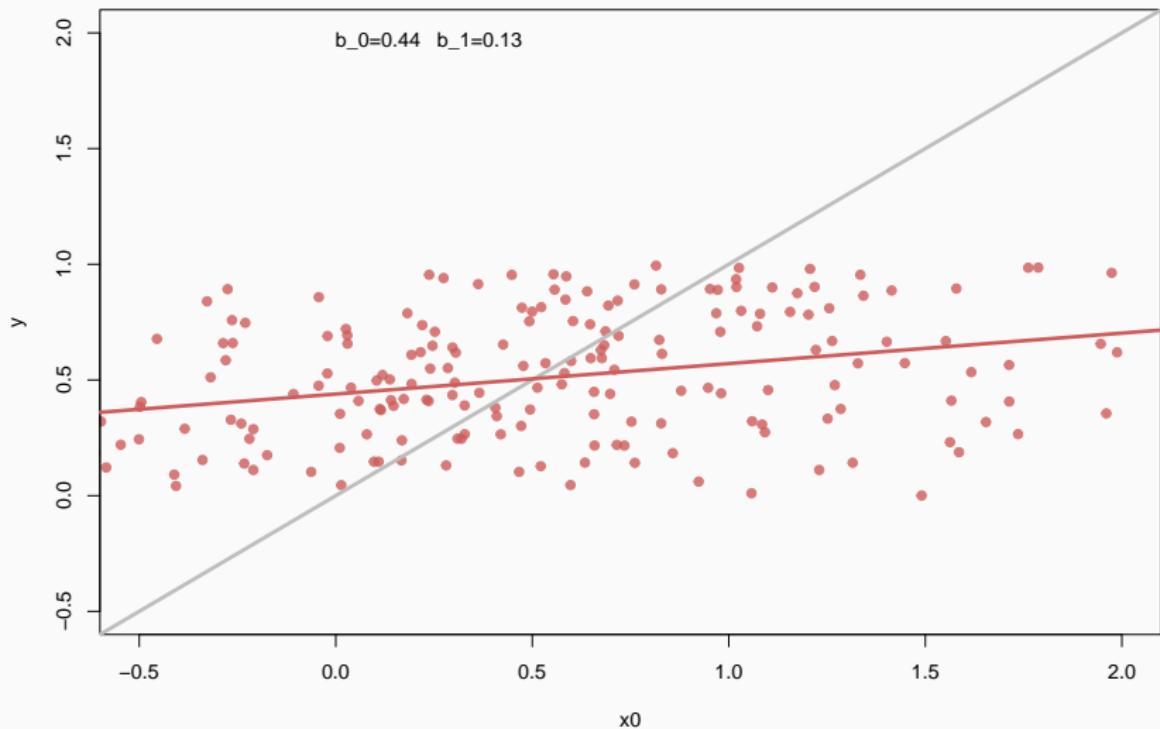
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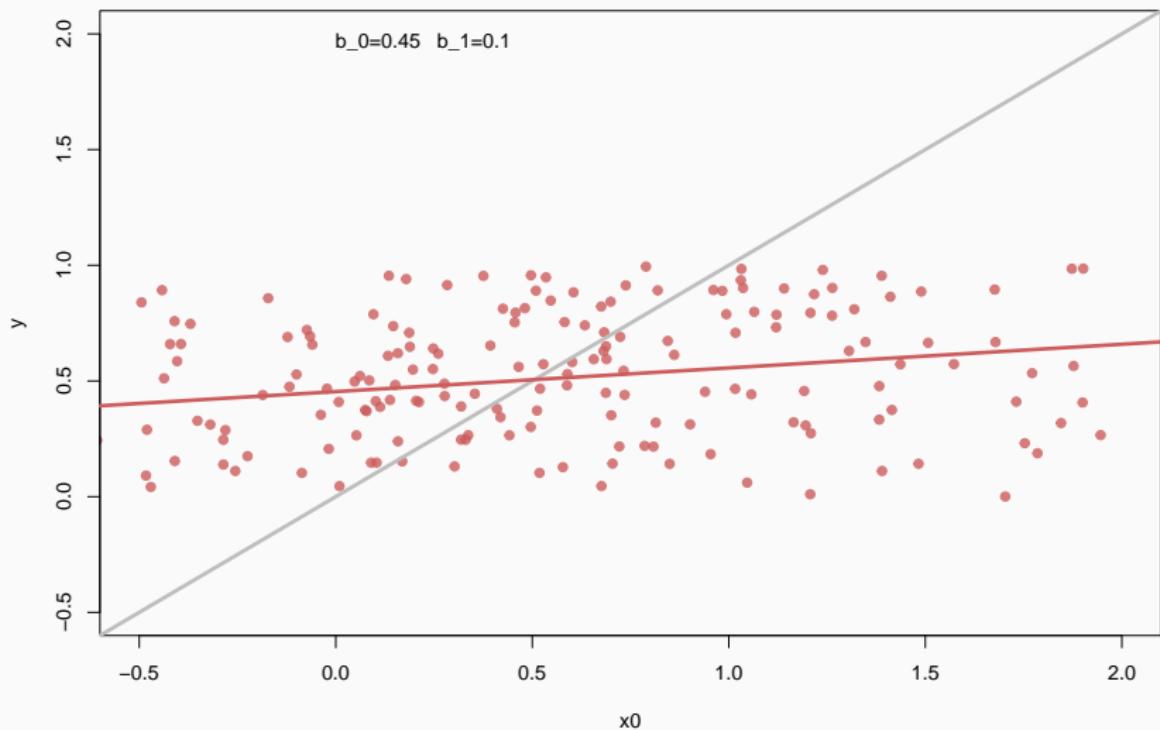
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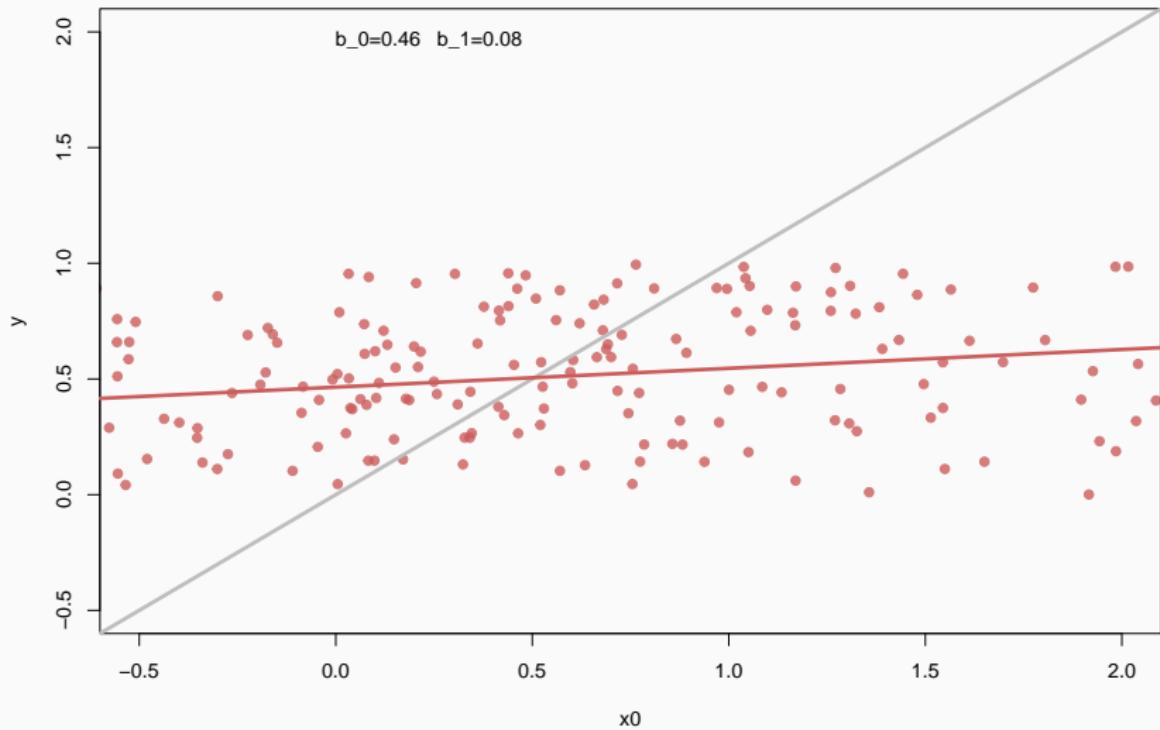
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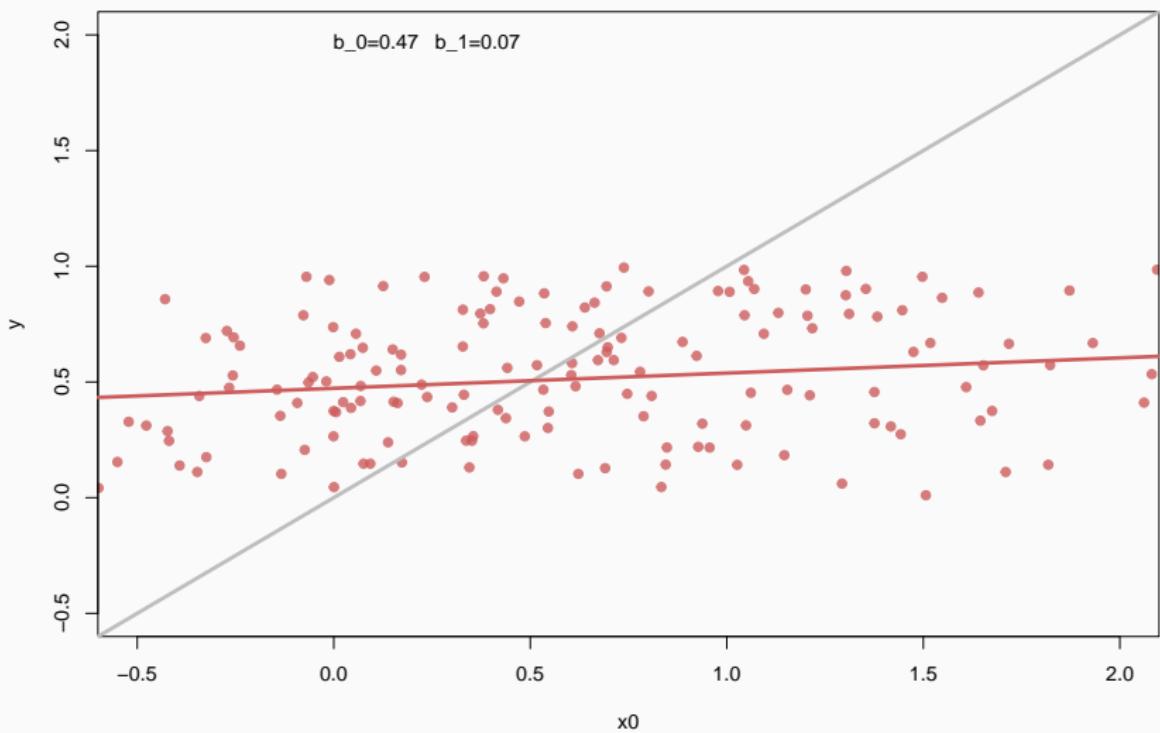
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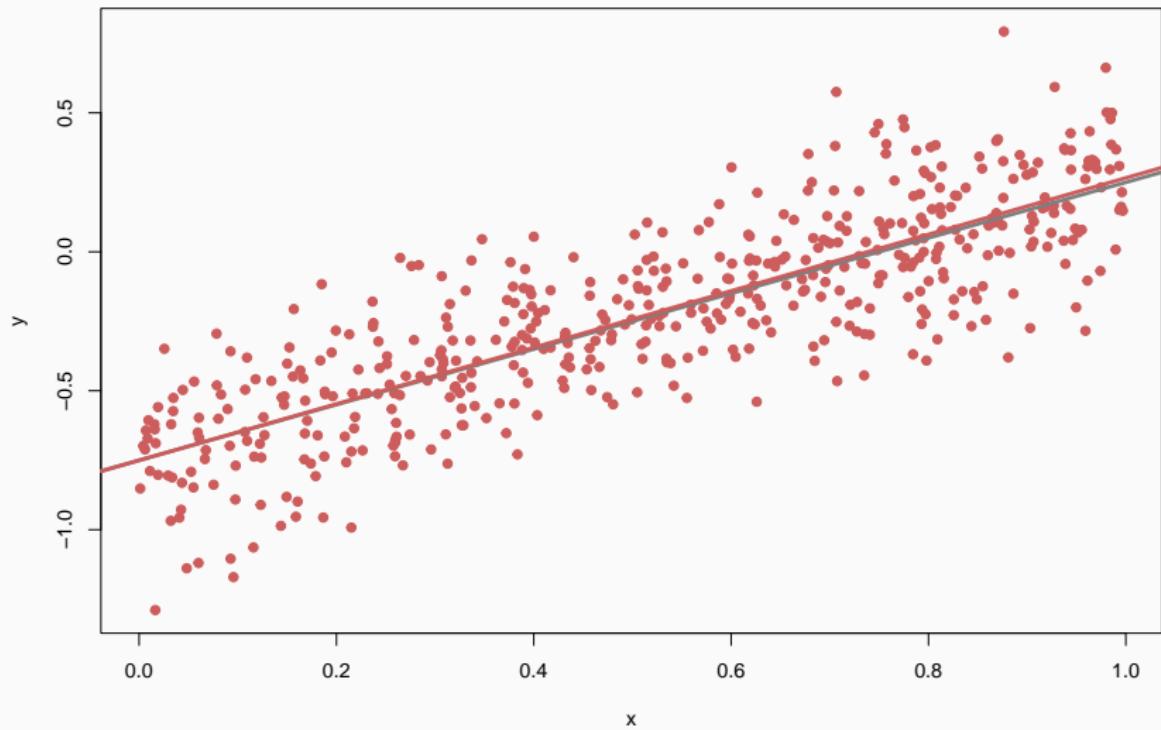
# Measurement error in $x$



## Truncation

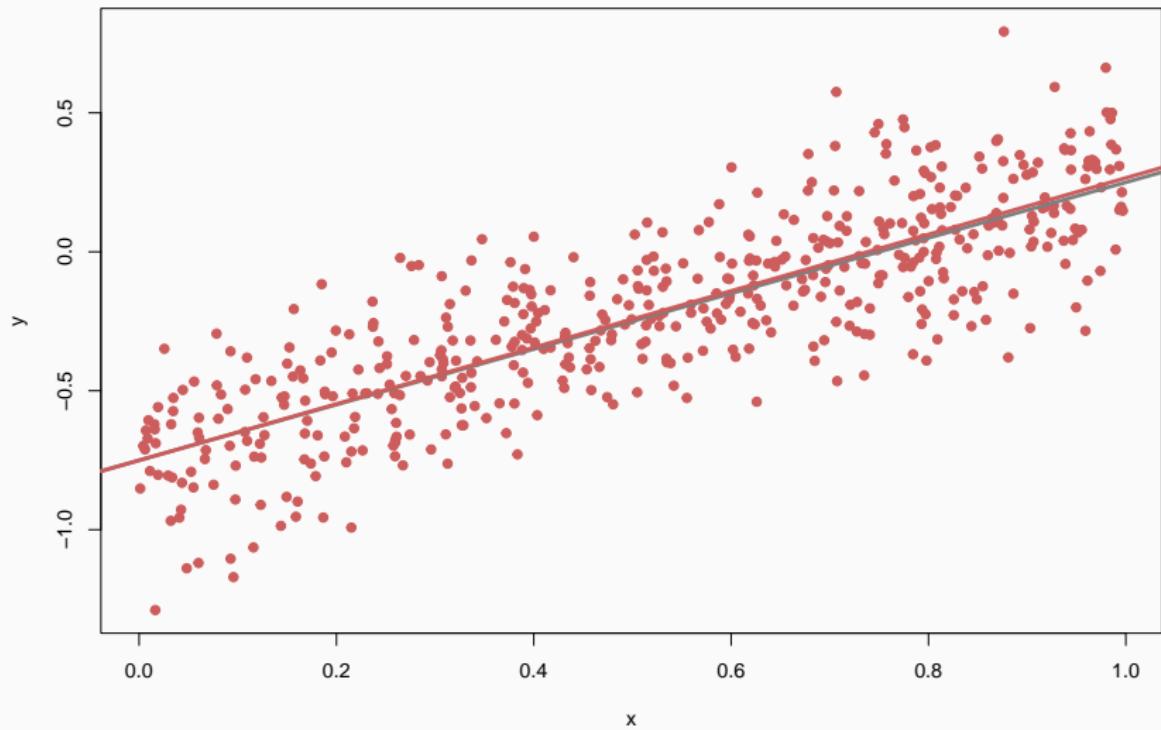
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# Truncated $y$



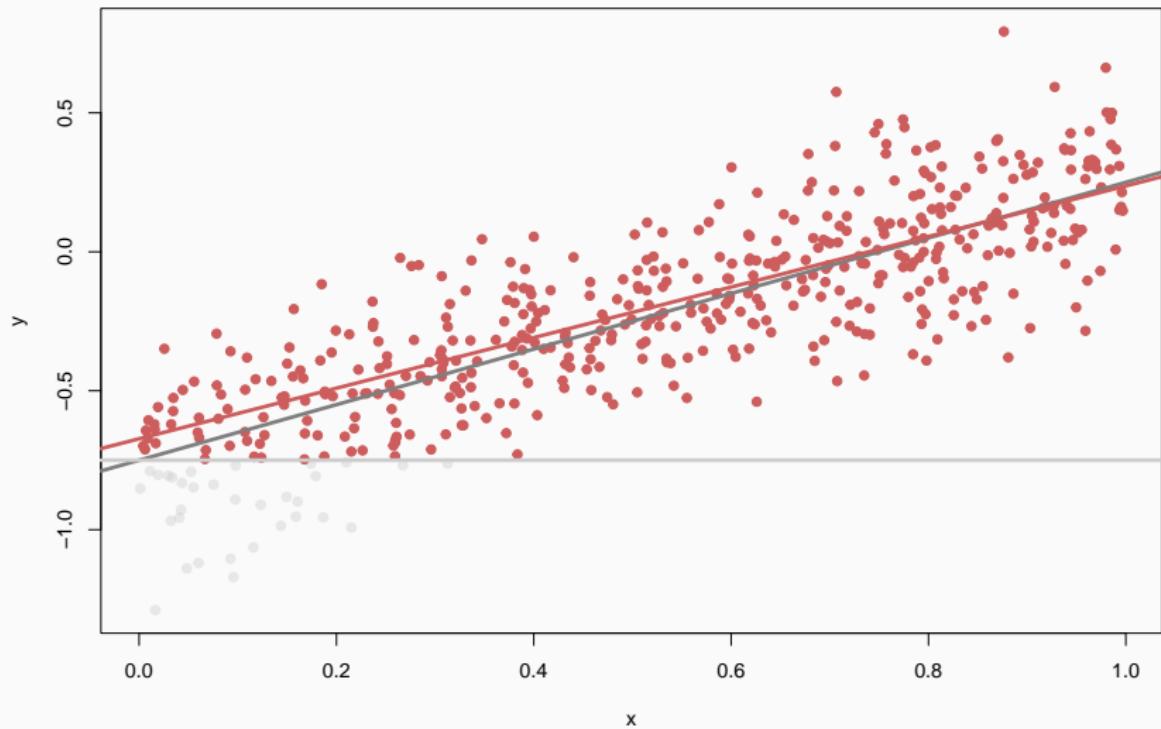
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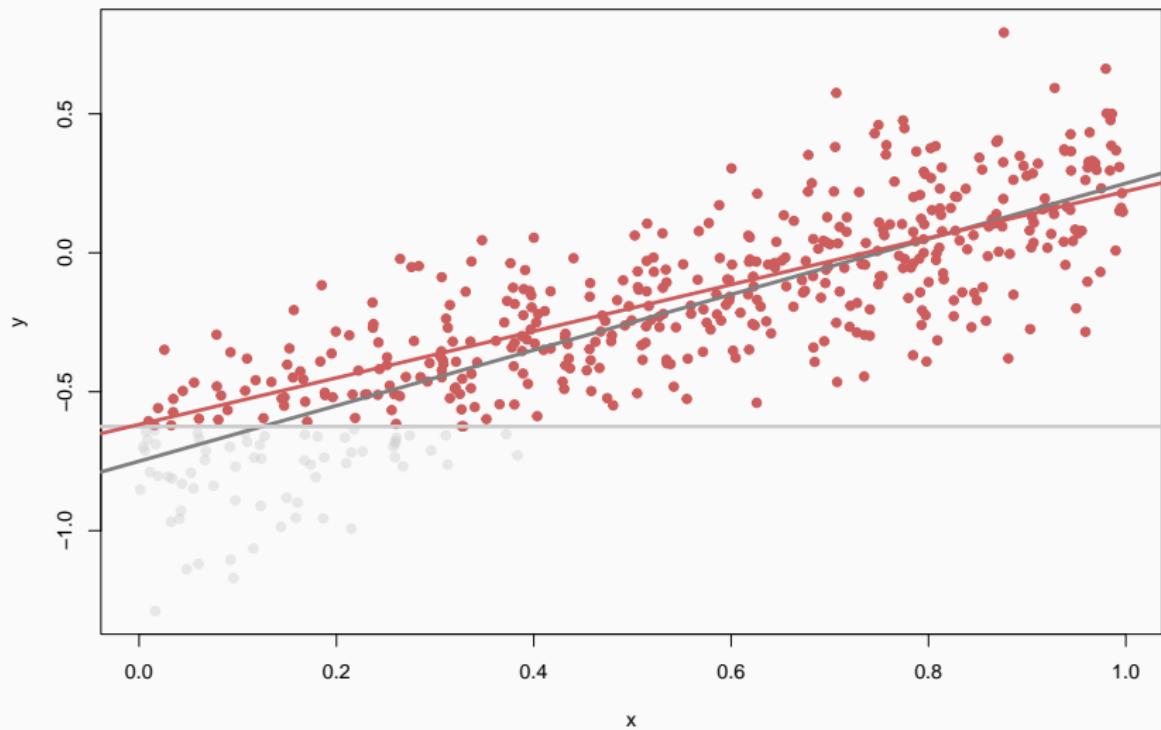
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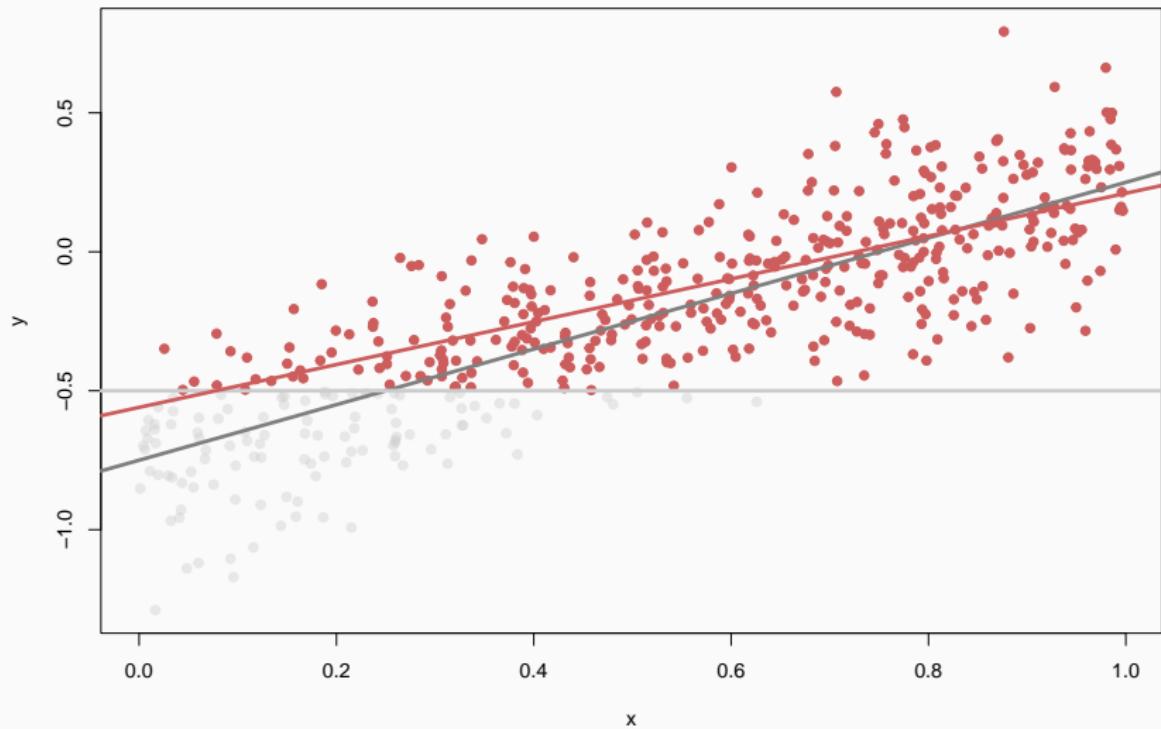
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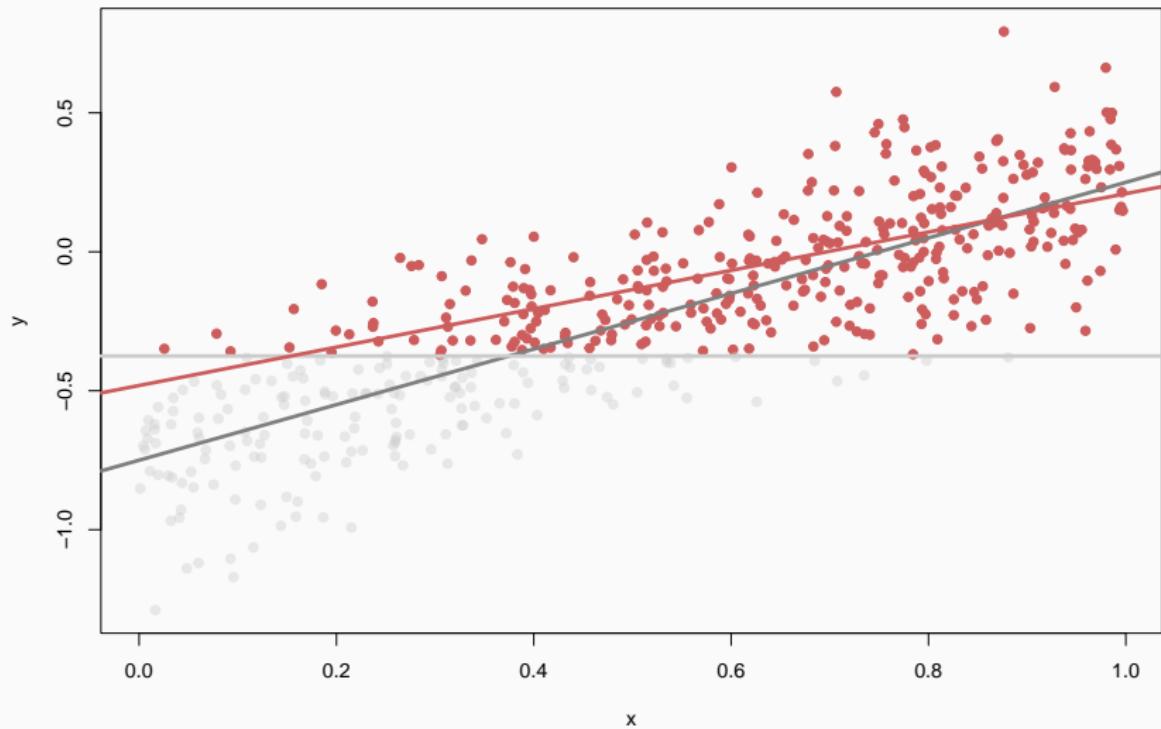
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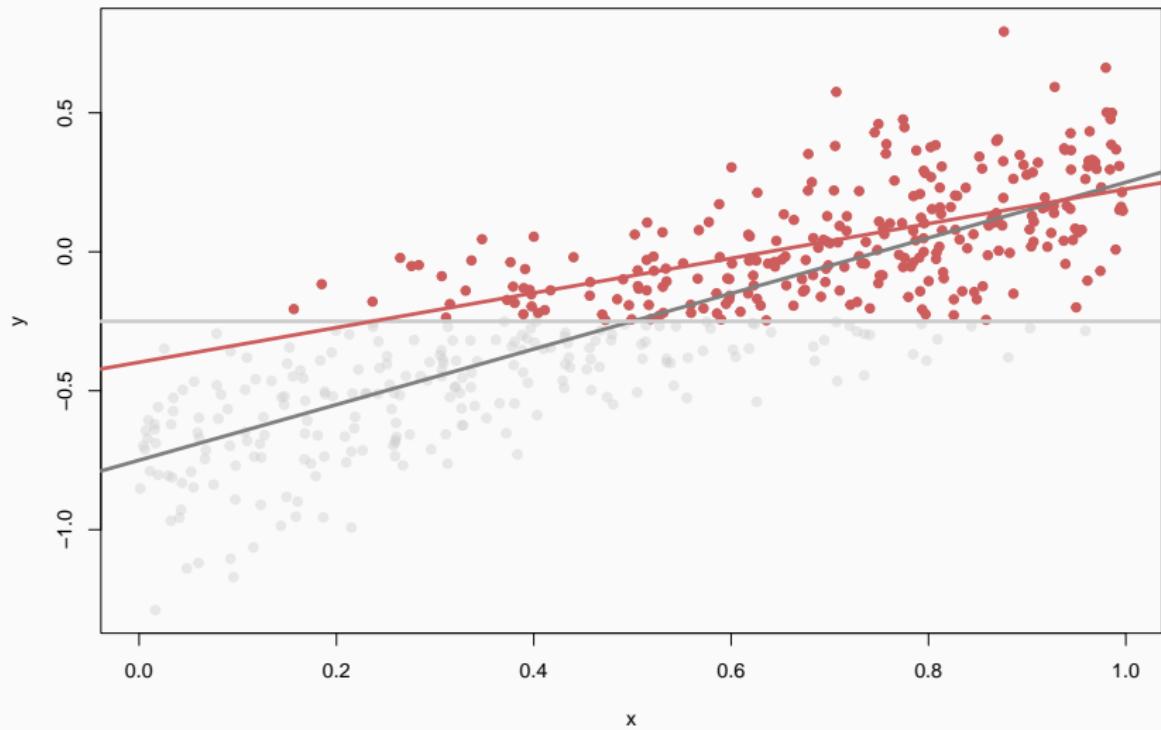
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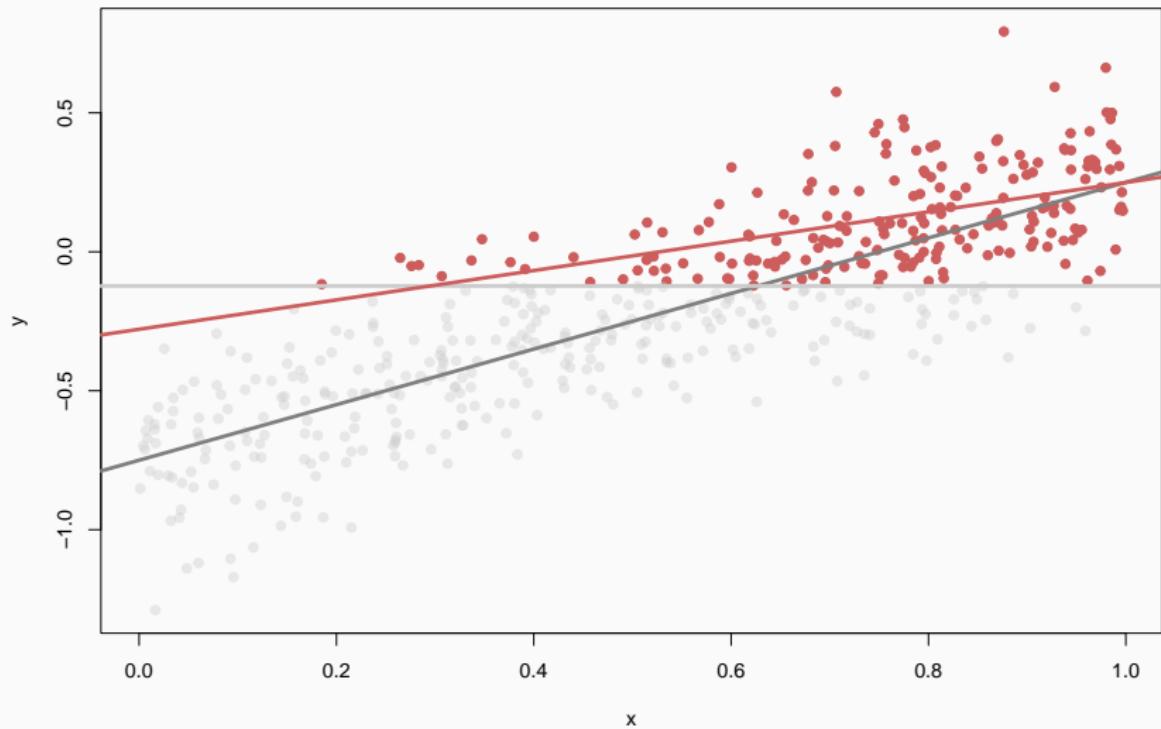
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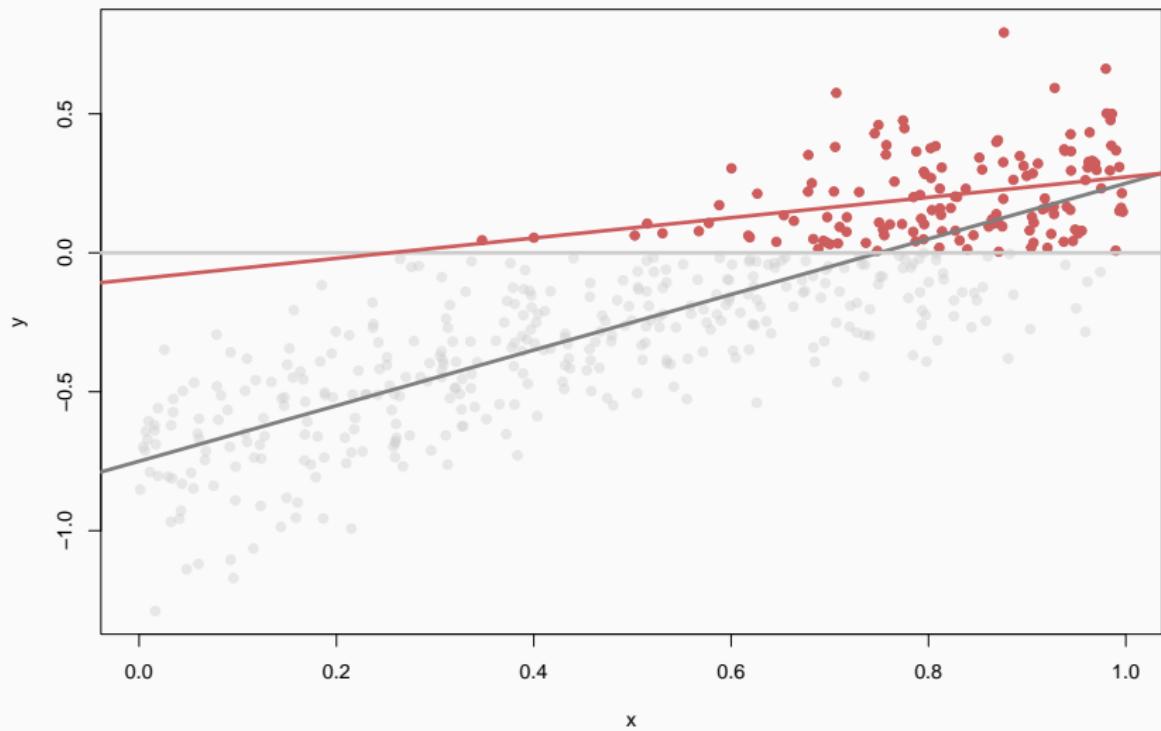
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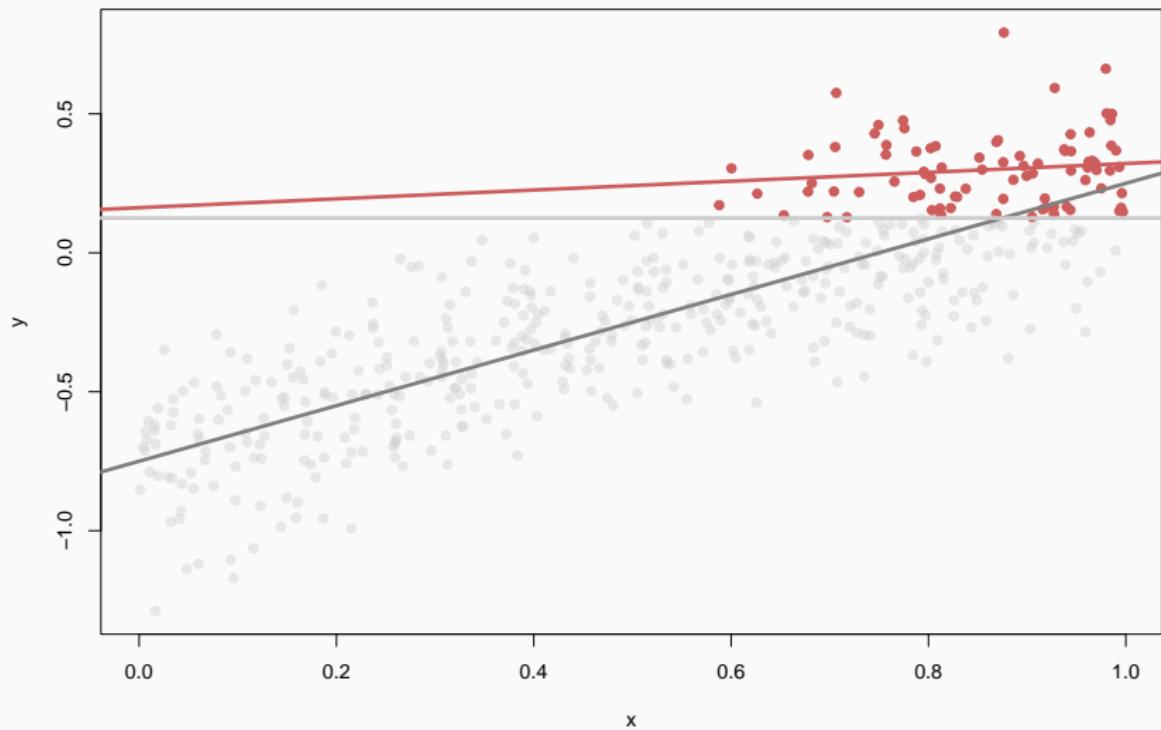
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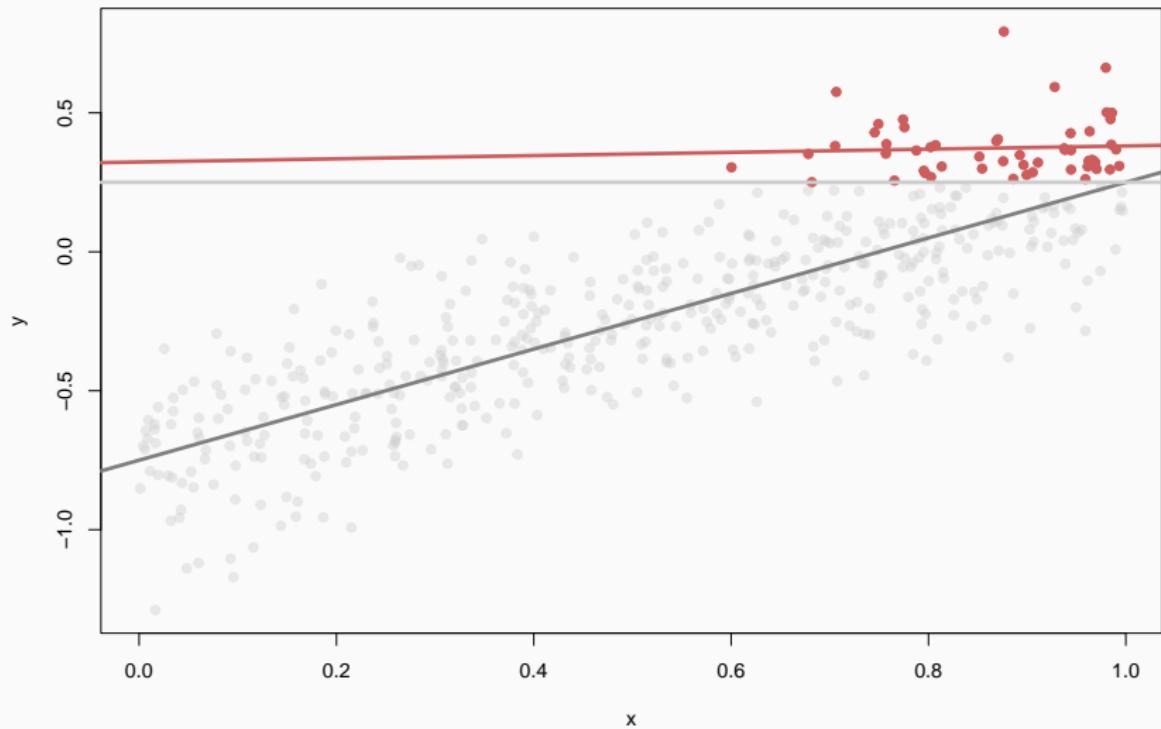
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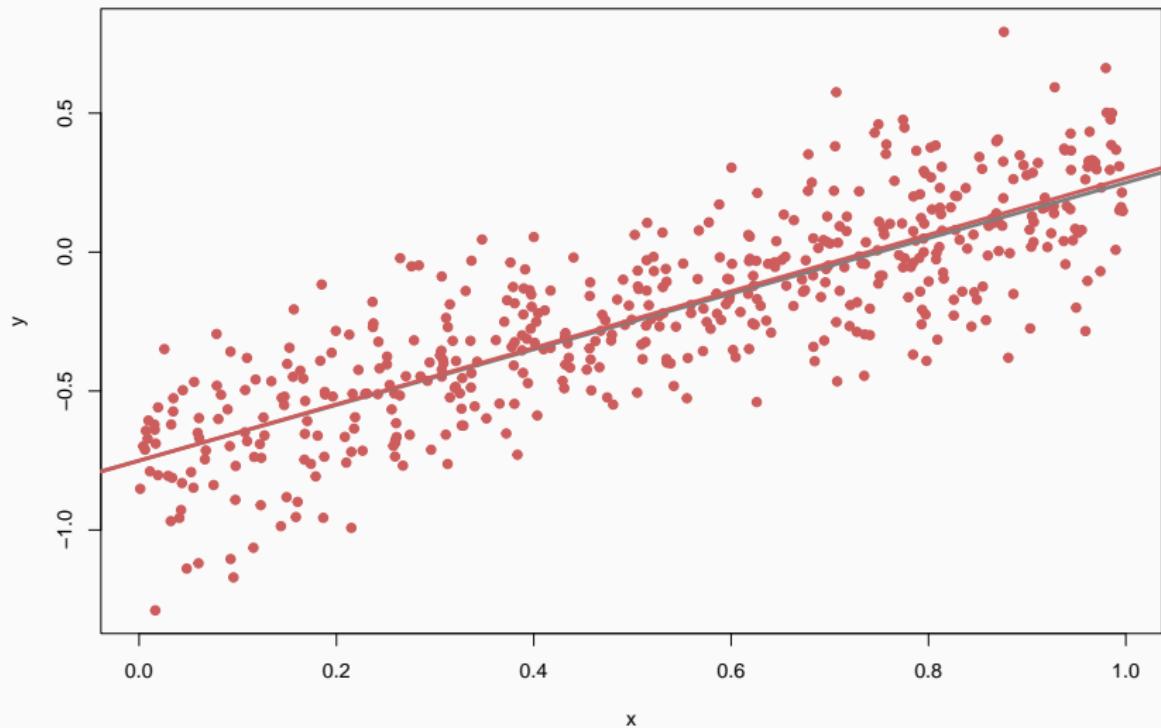
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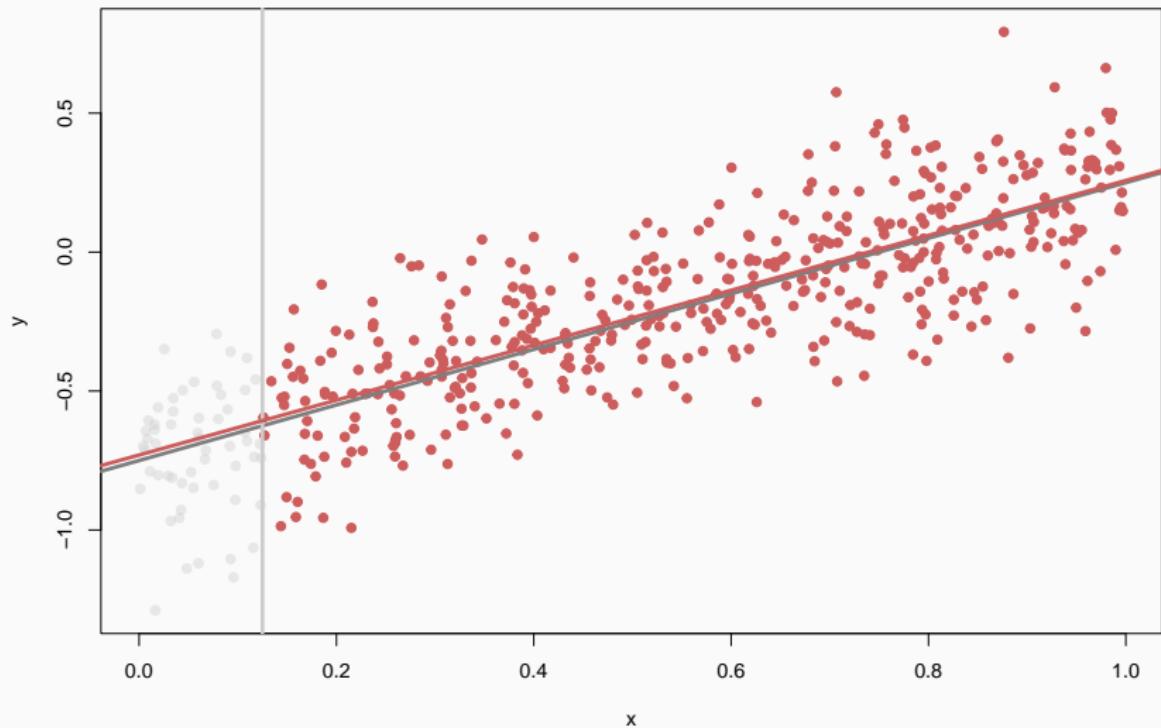


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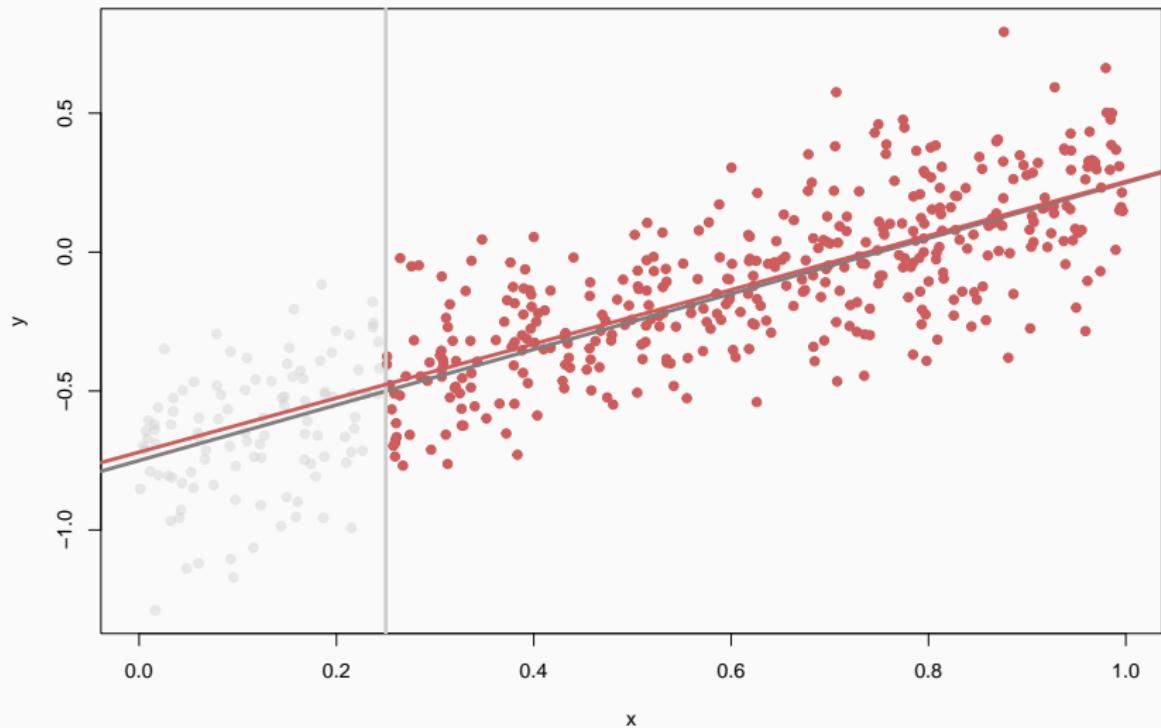
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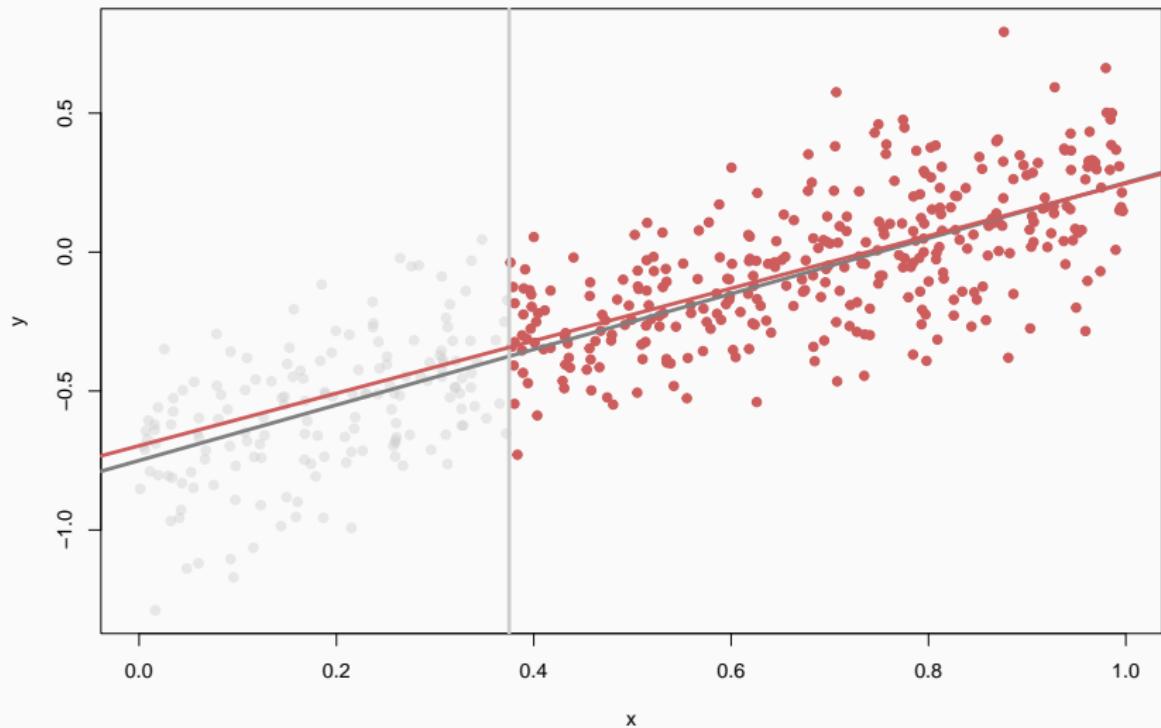
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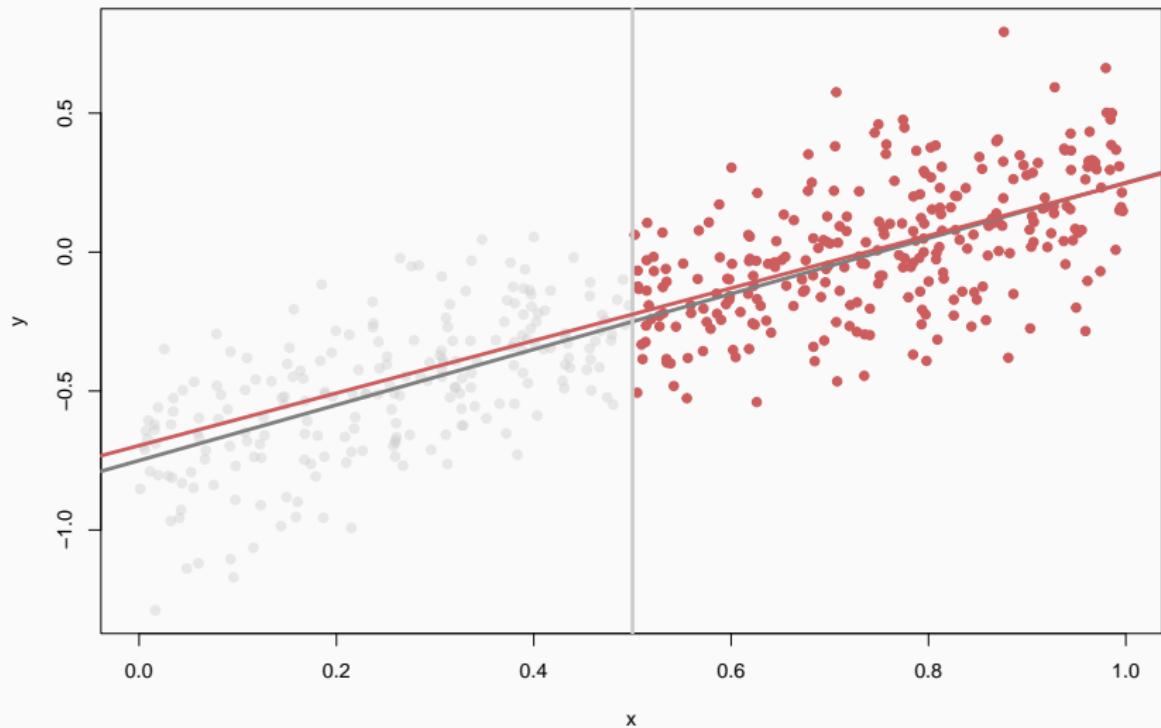
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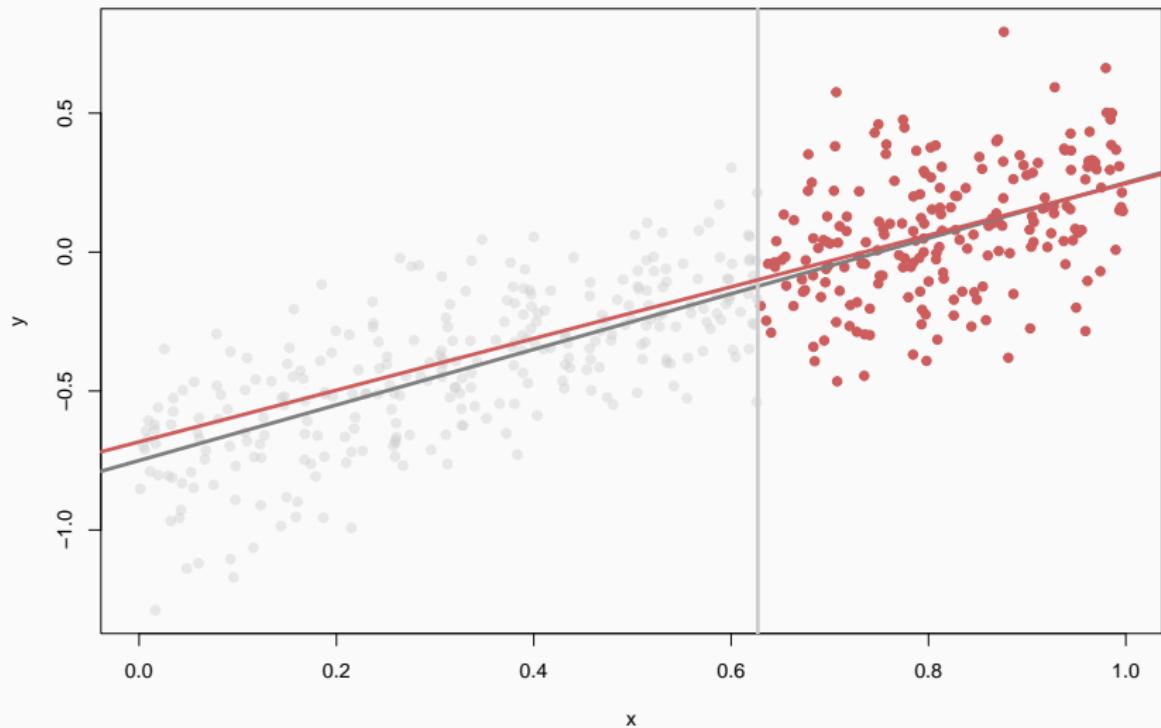
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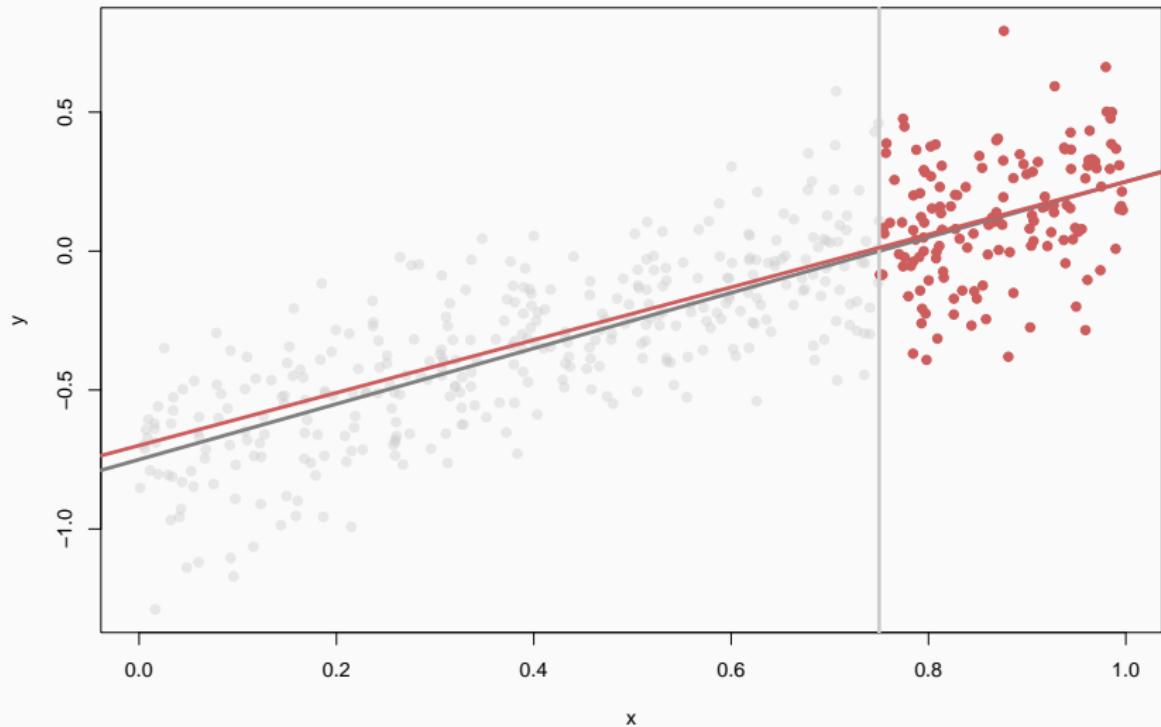
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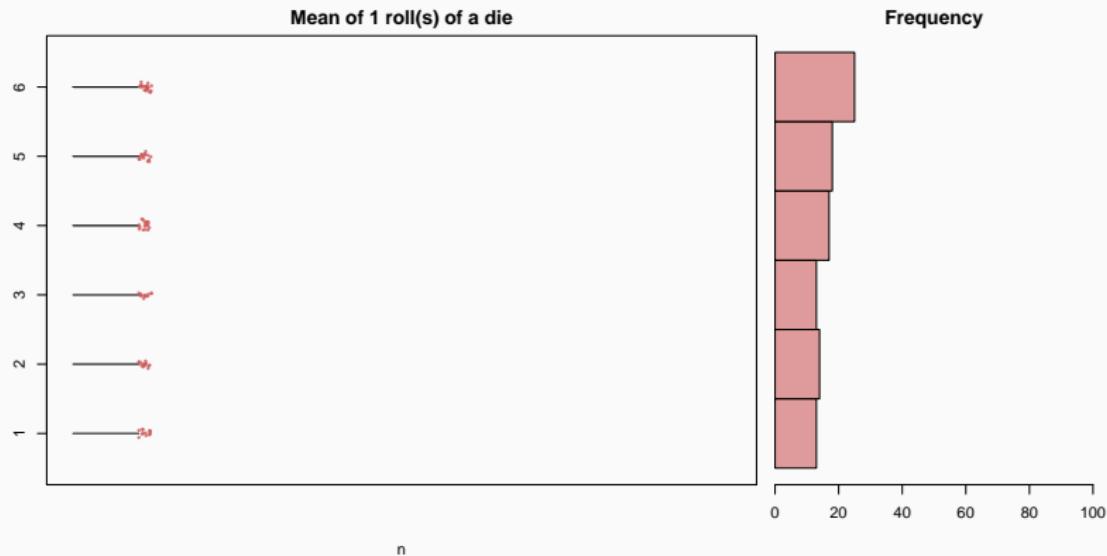
## Convergence Concepts

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## WLLN – Example

After each roll, each student computes the mean of their past rolls.

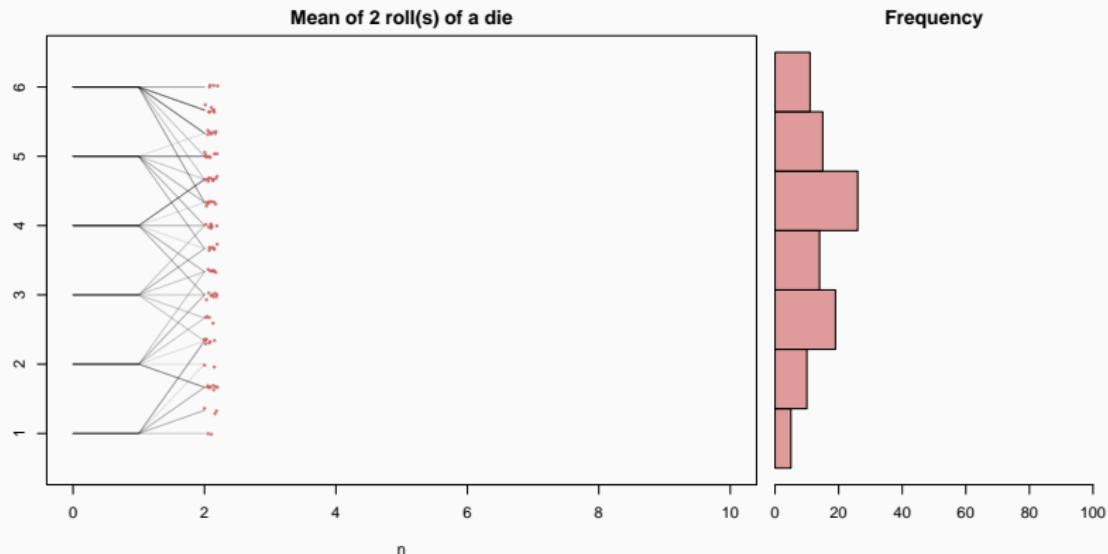
This mean,  $\bar{y}$ , is our  $y_n$ , and the WLLN tells us that  $y_n \xrightarrow{P} \mu = 3.5$ .



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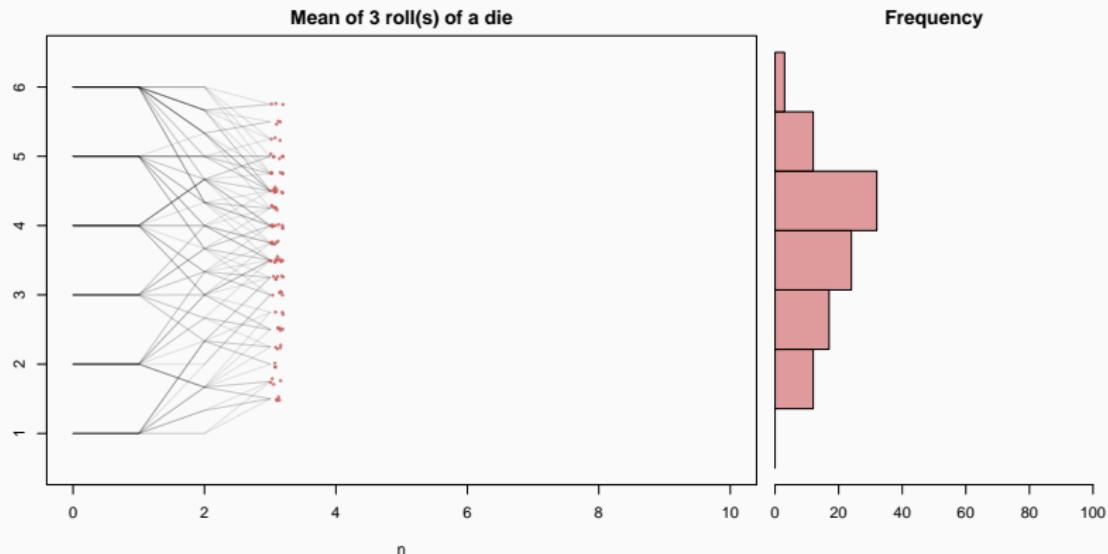
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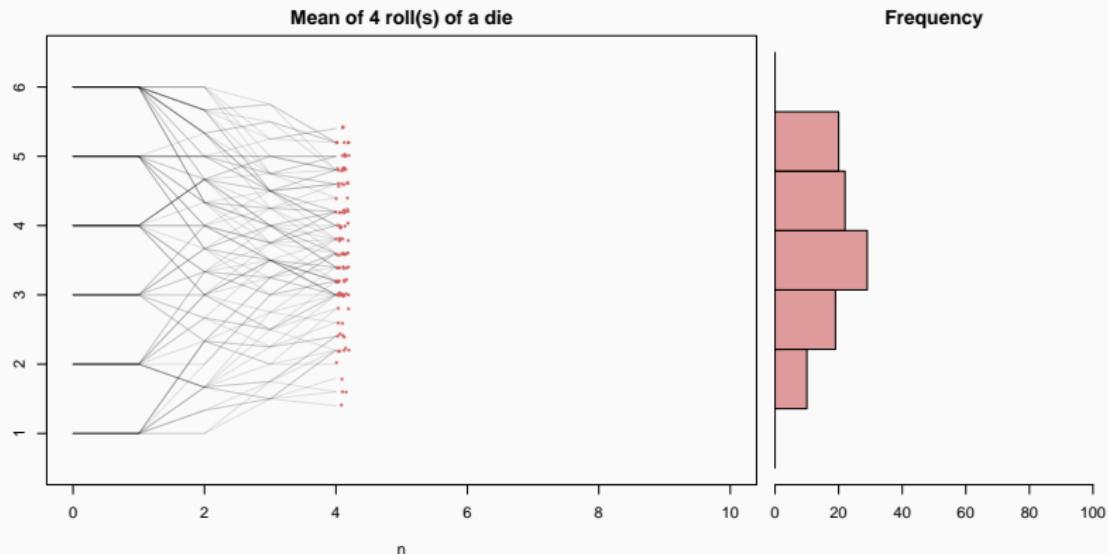
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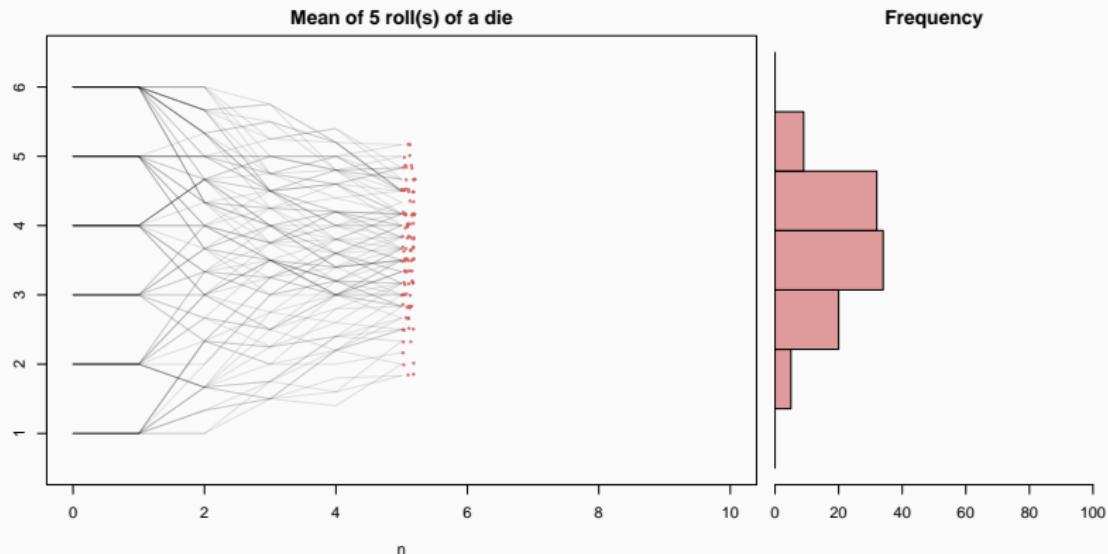
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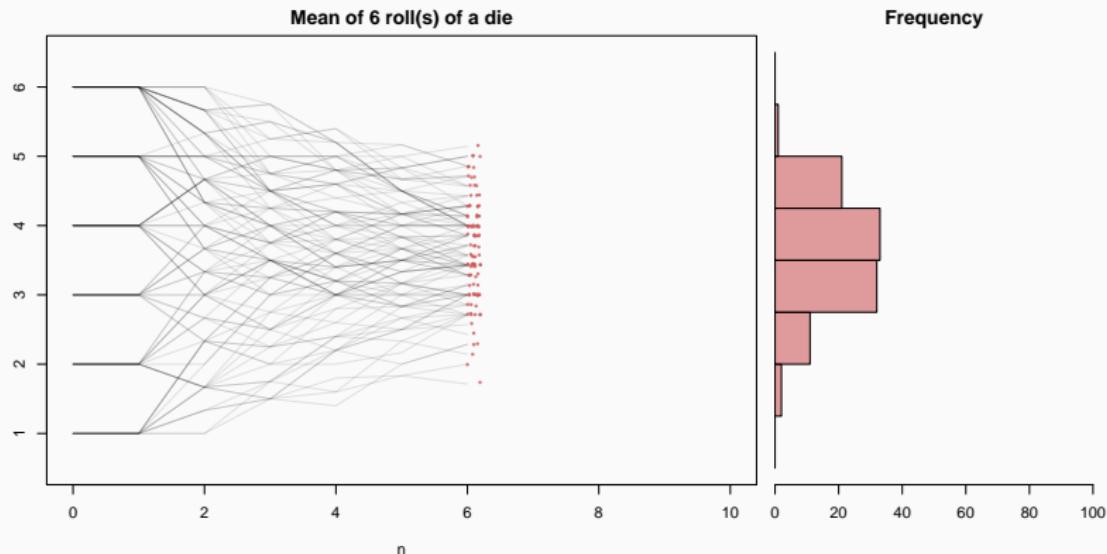
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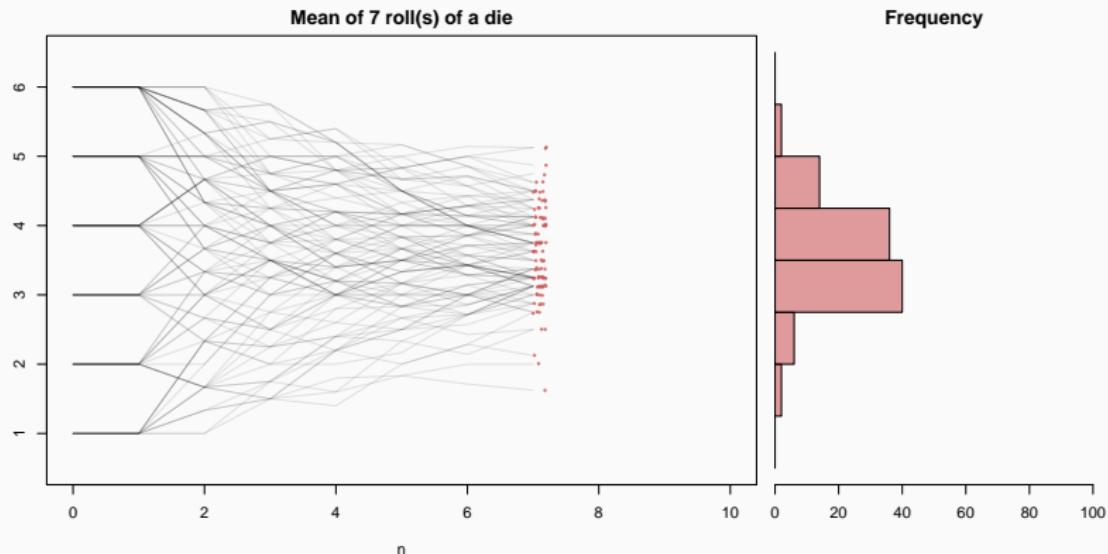
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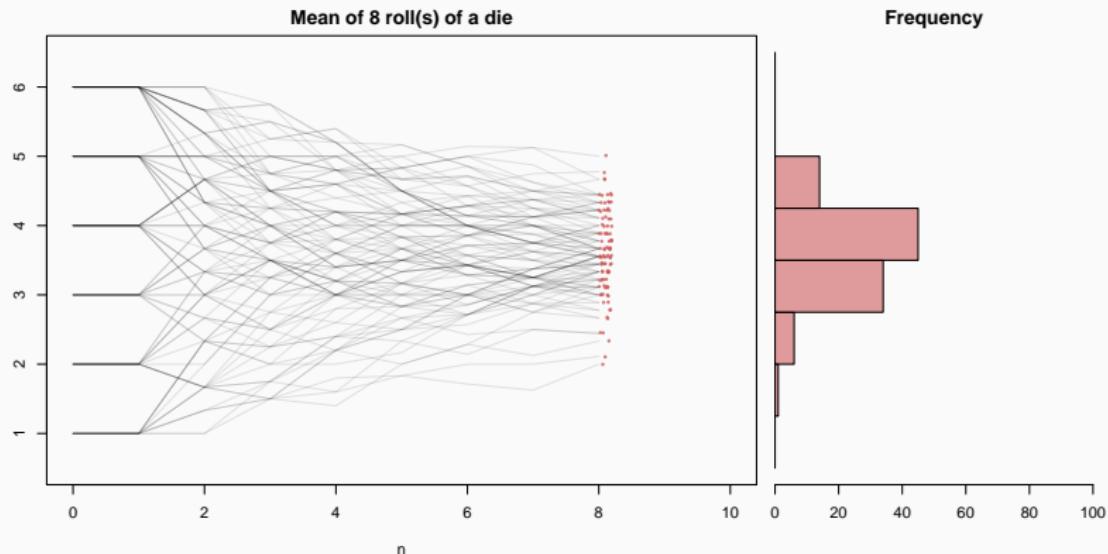
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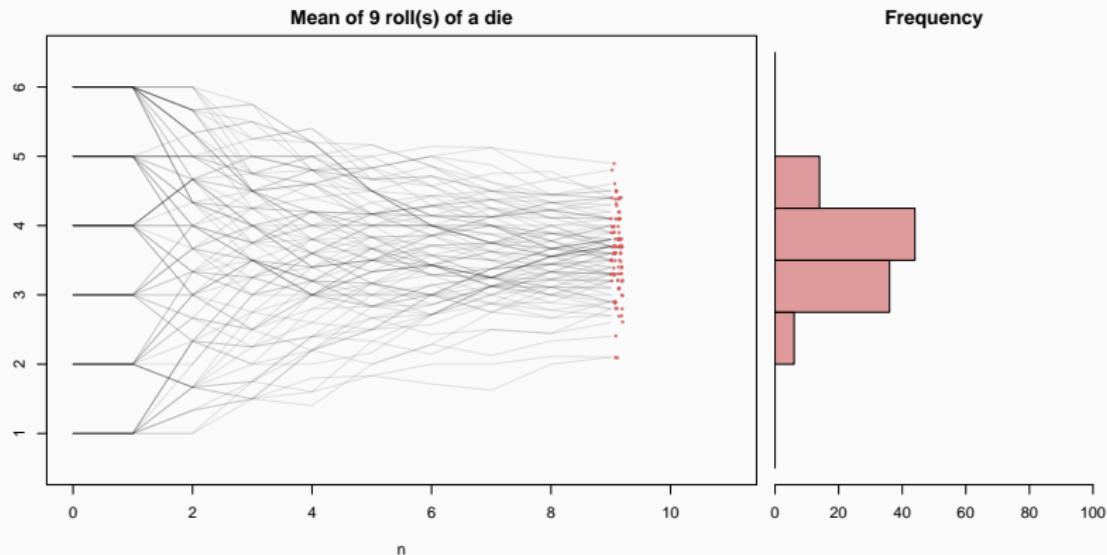
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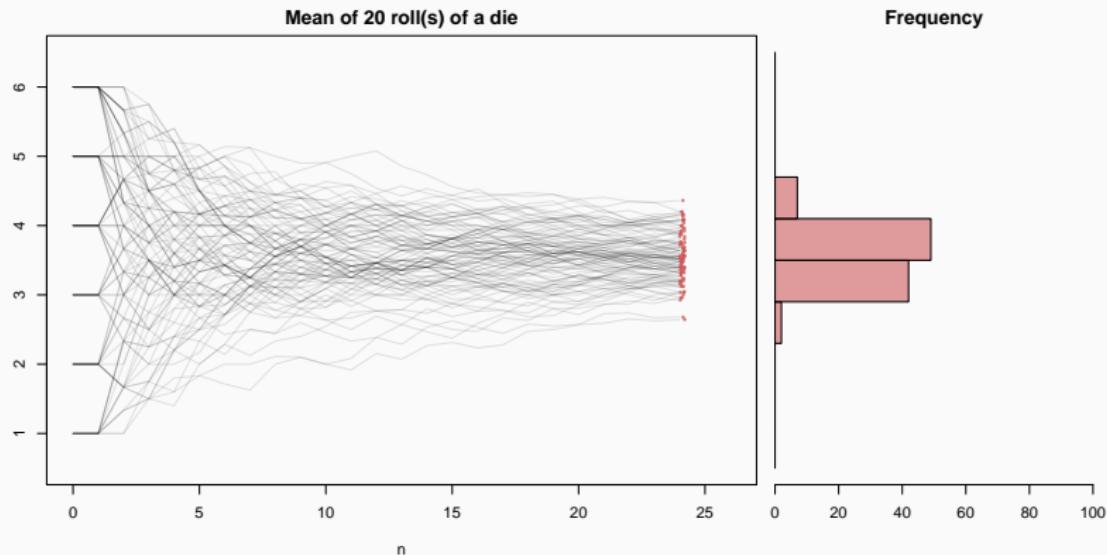
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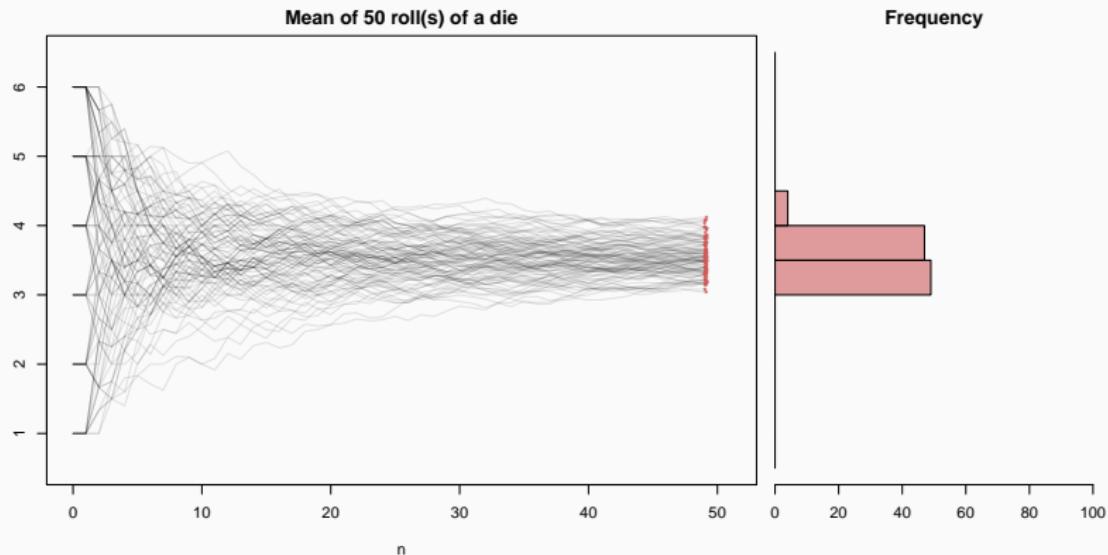
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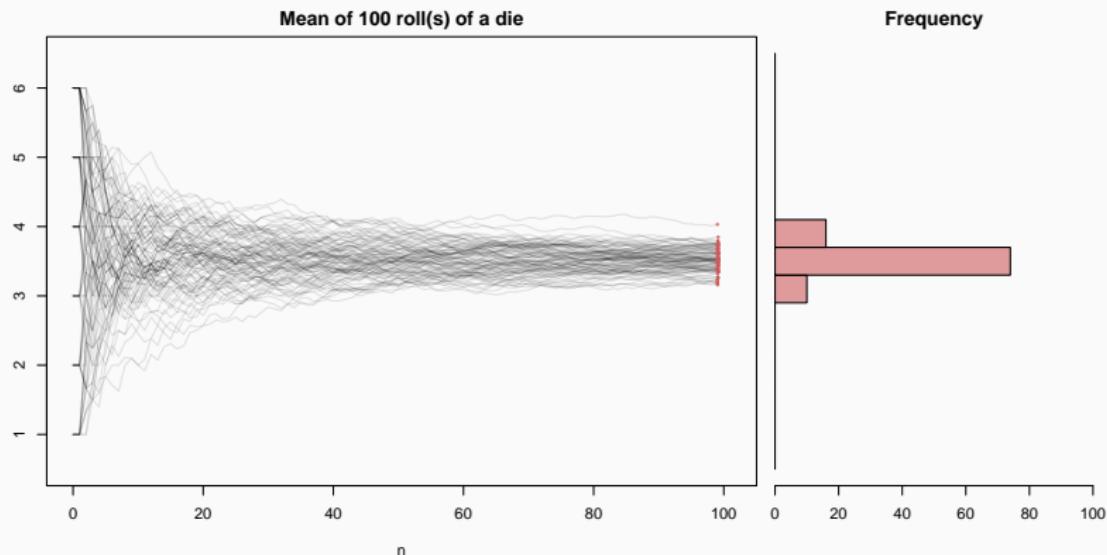
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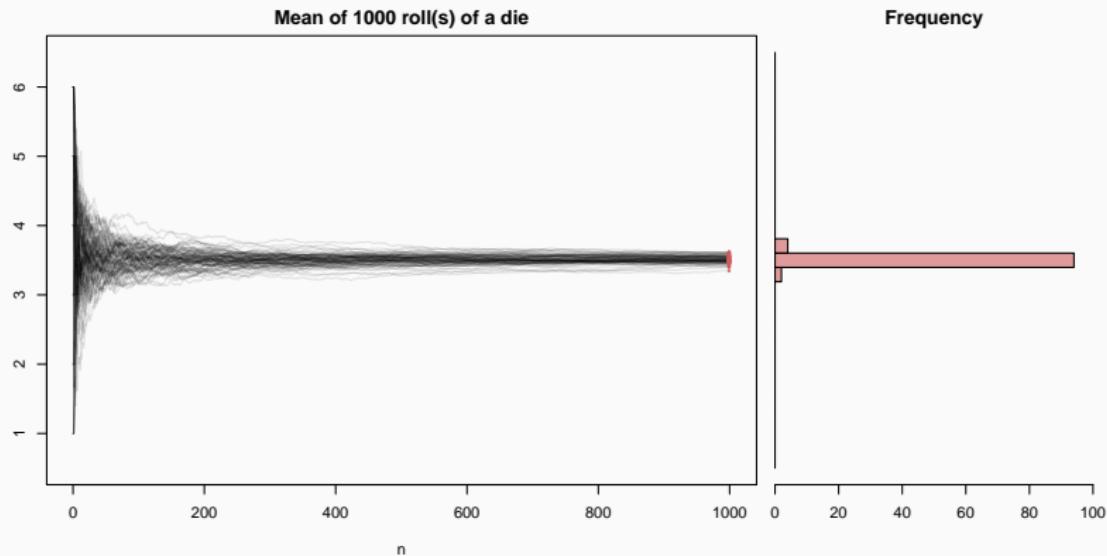
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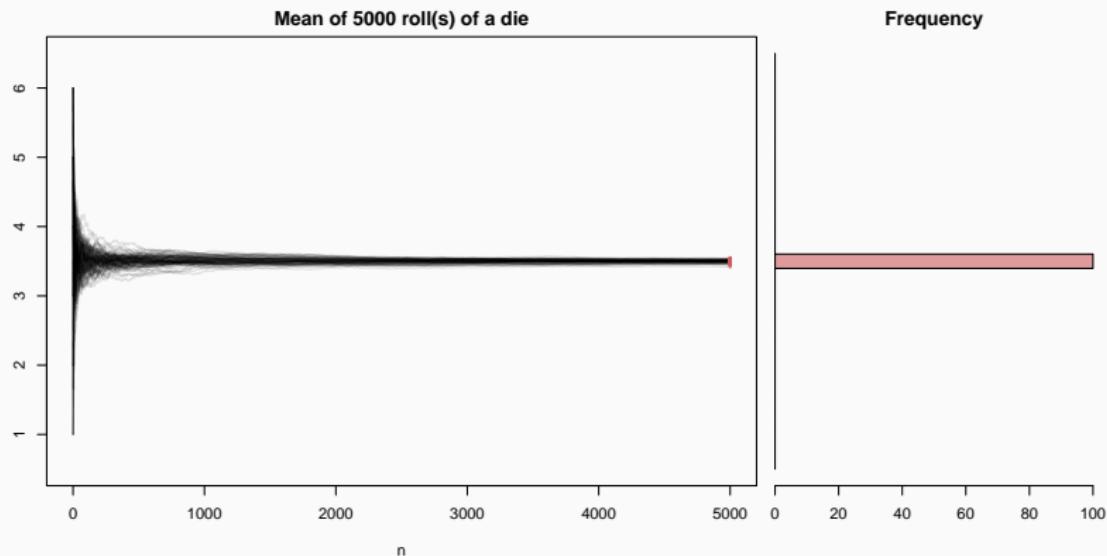
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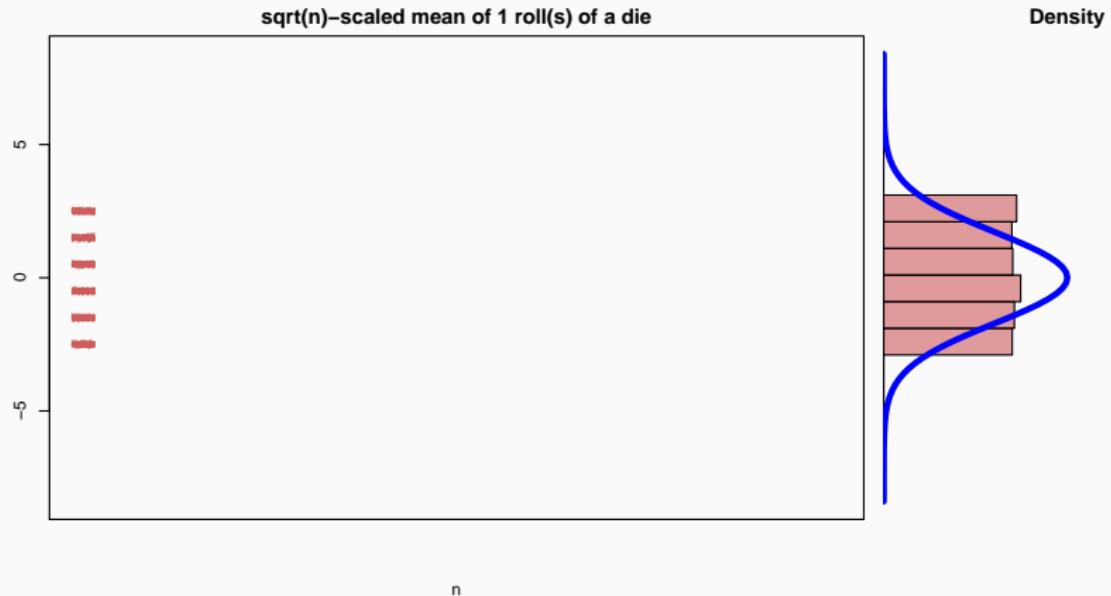


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After each roll, each student computes the mean of their past rolls.

Before, we looked at  $\bar{x}_n$ , now we look at  $\sqrt{n}(\bar{x}_n - \mu)$ .

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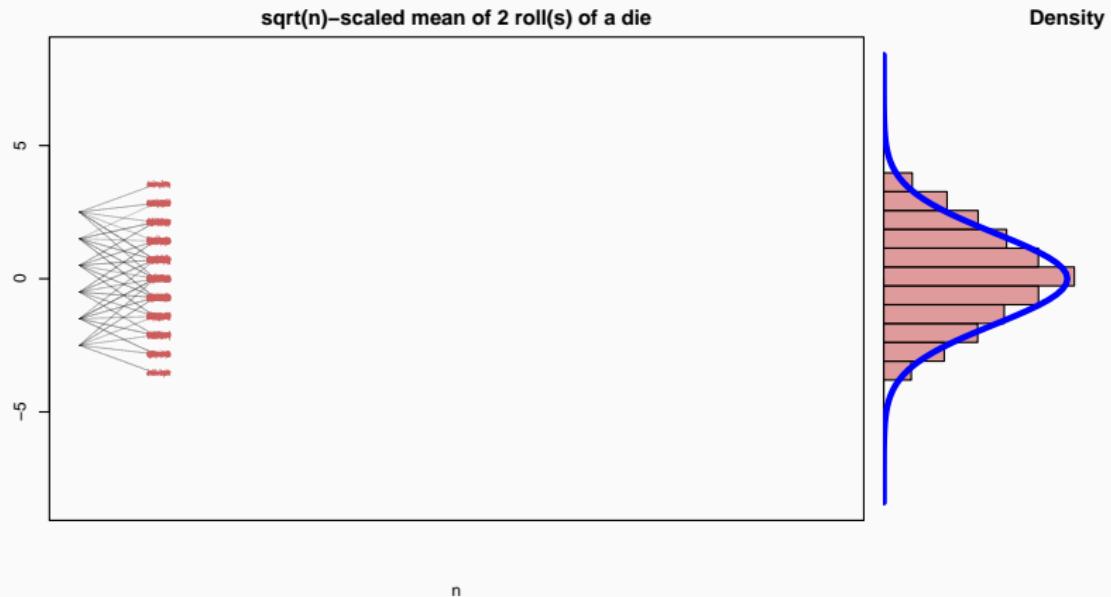


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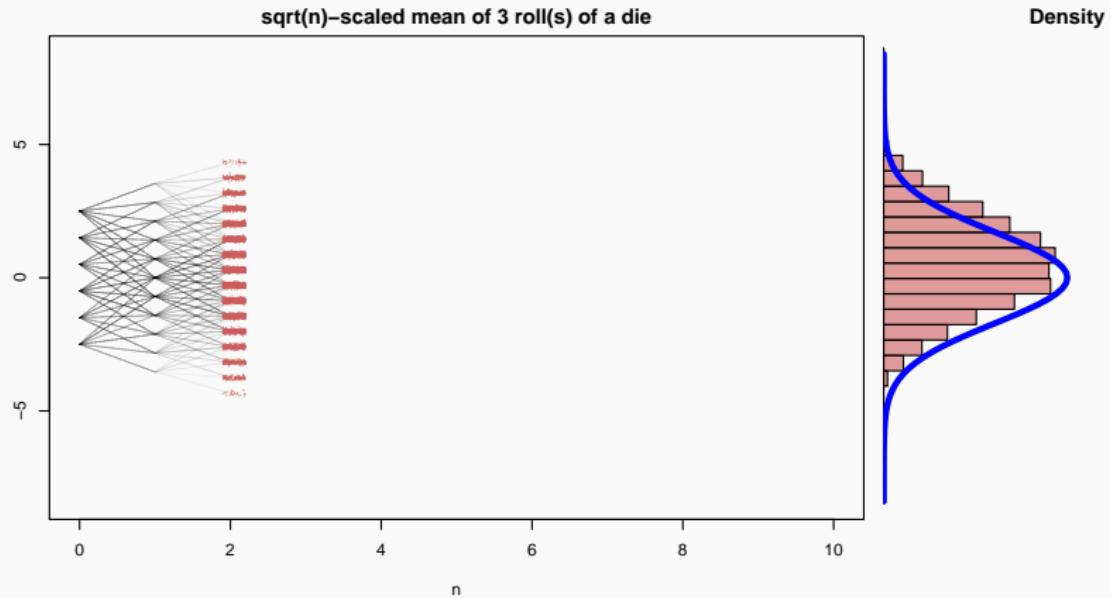


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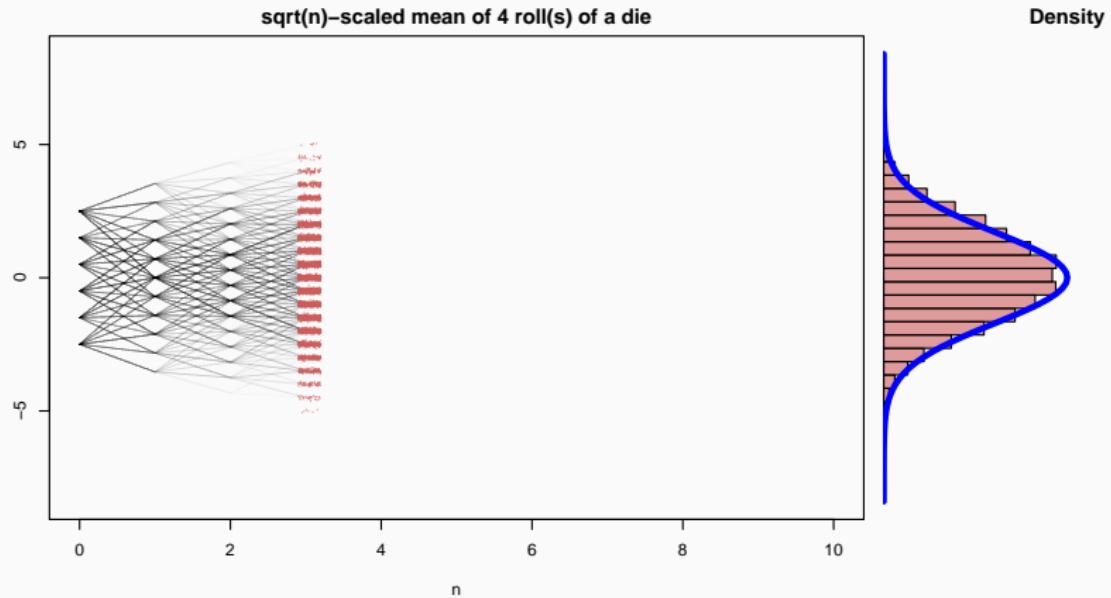


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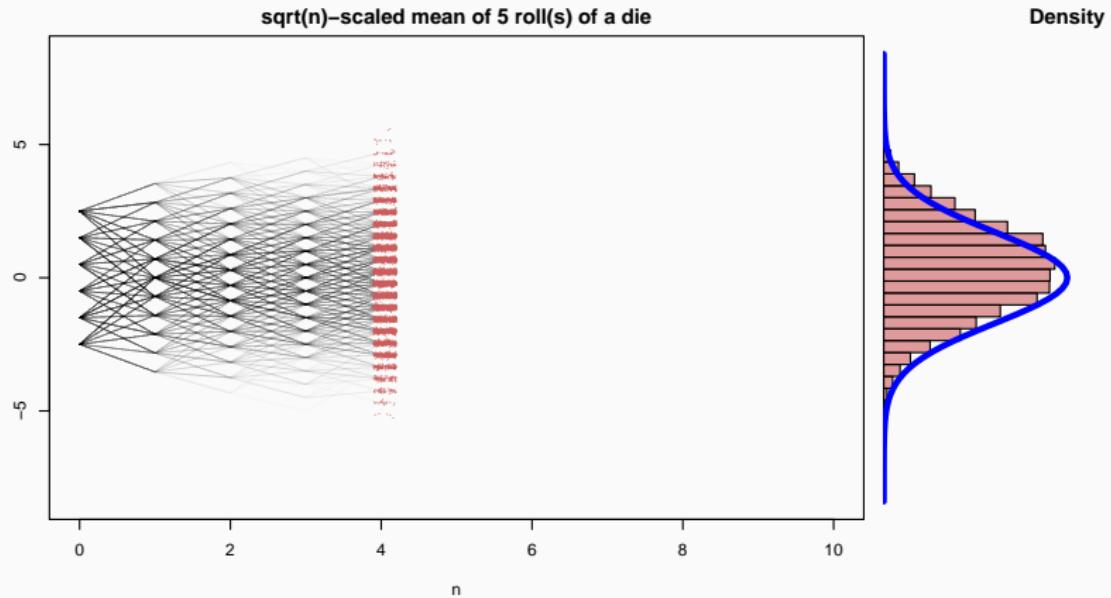


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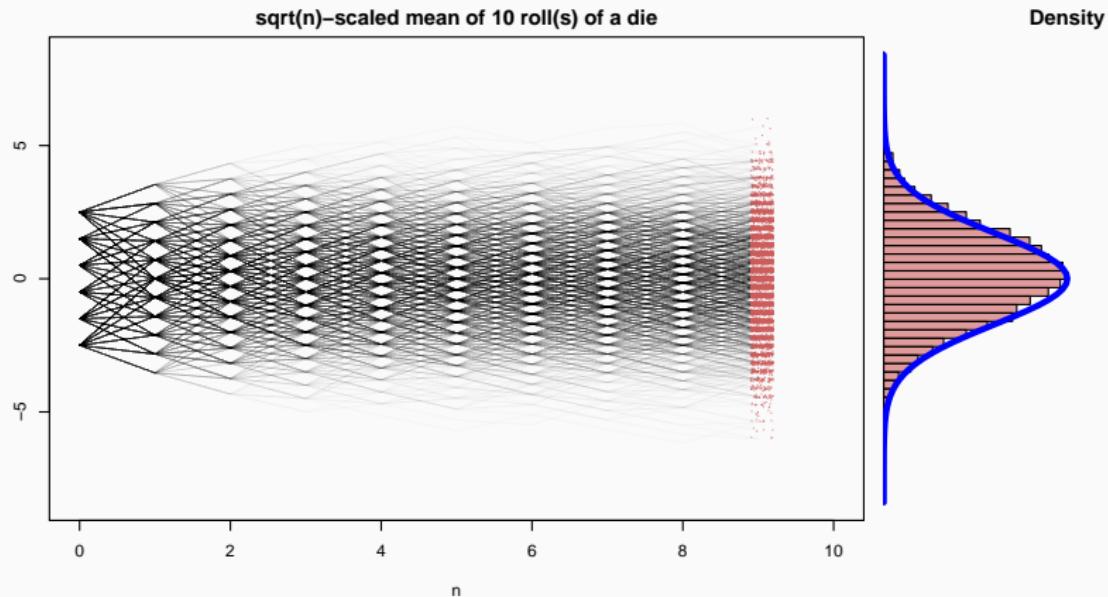


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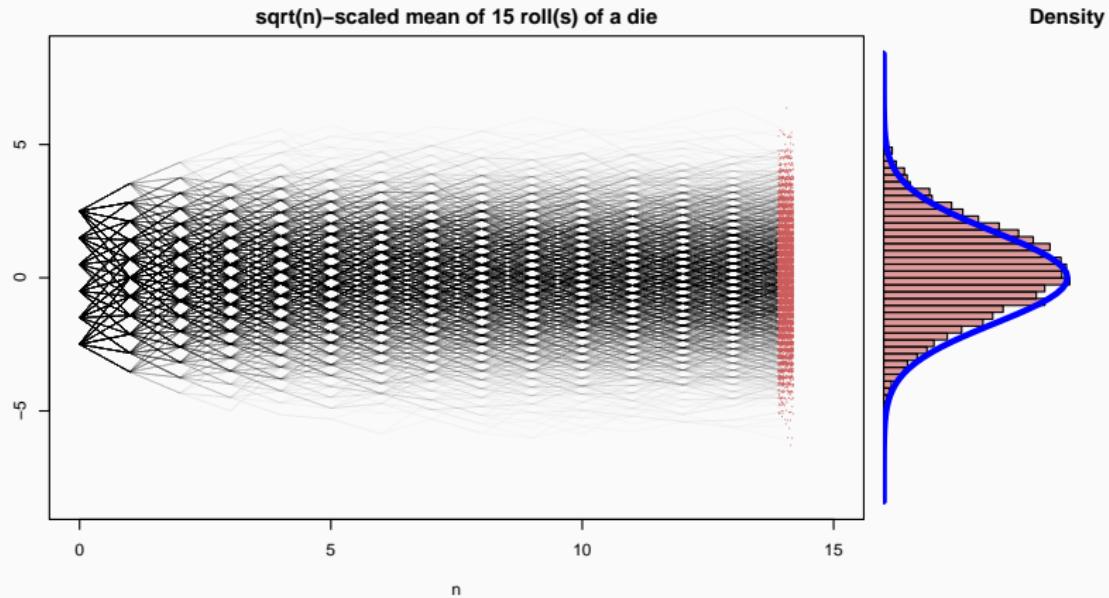


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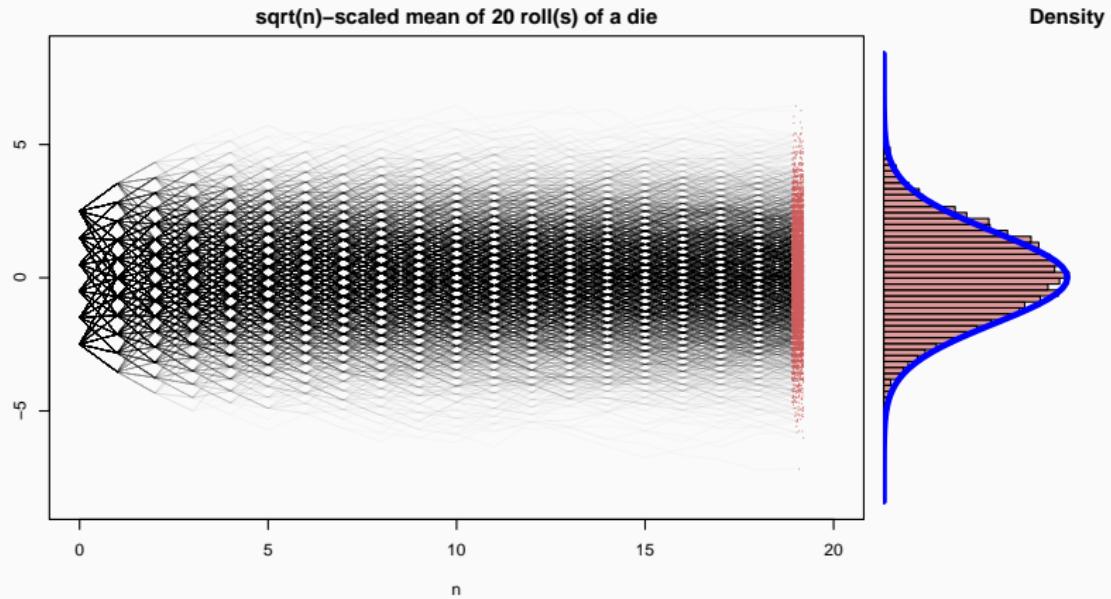


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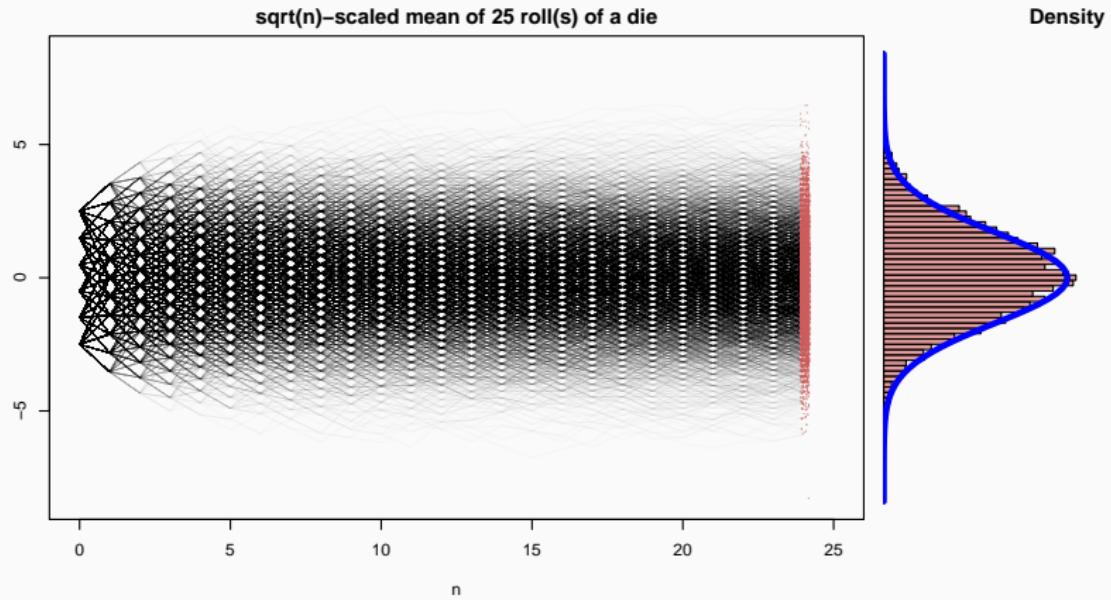


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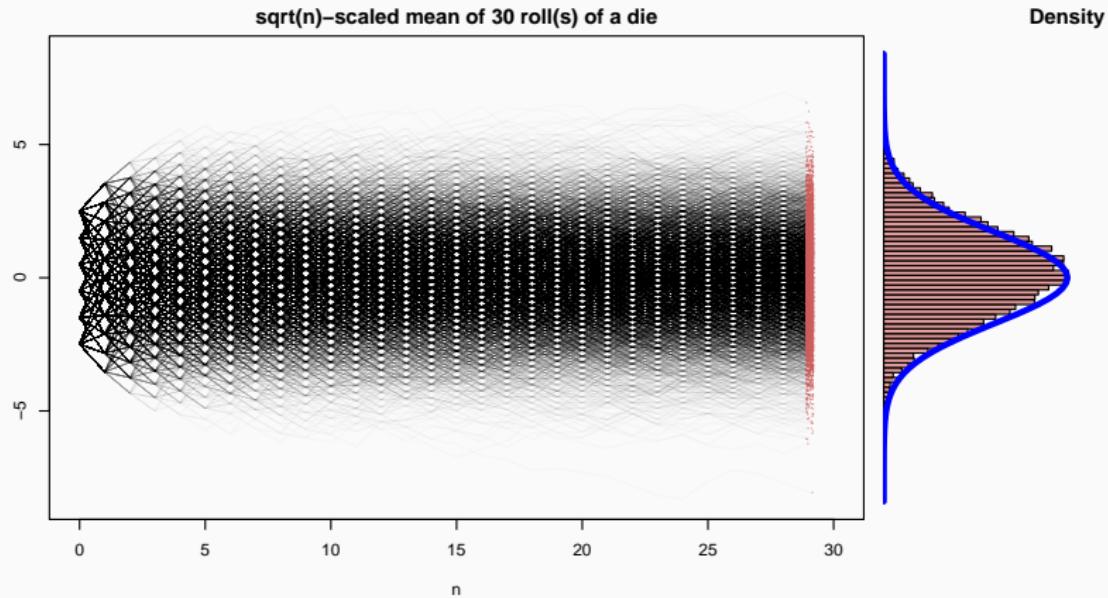


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After each roll, each student computes the mean of their past rolls.

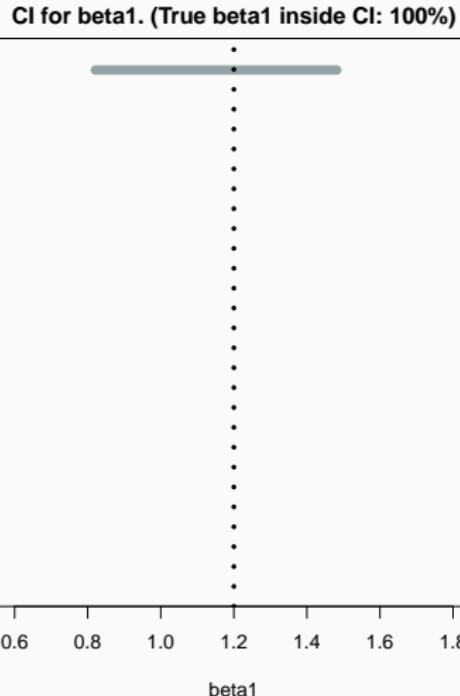
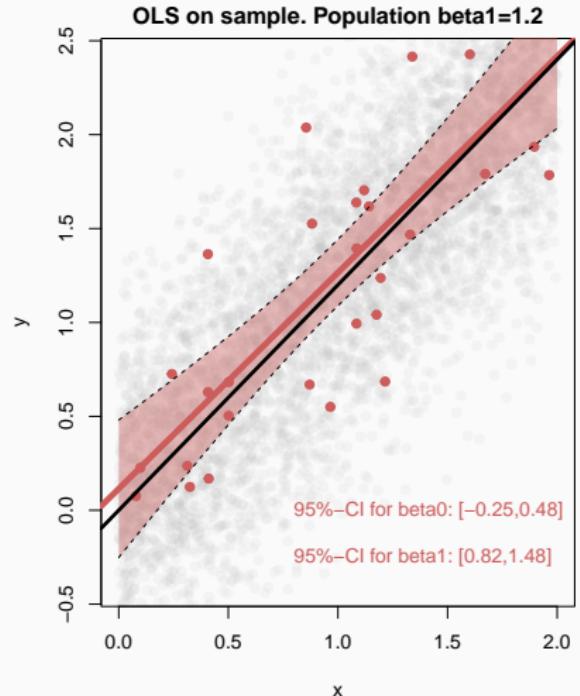
Before, we looked at  $\bar{x}_n$ , now we look at  $\sqrt{n}(\bar{x}_n - \mu)$ .

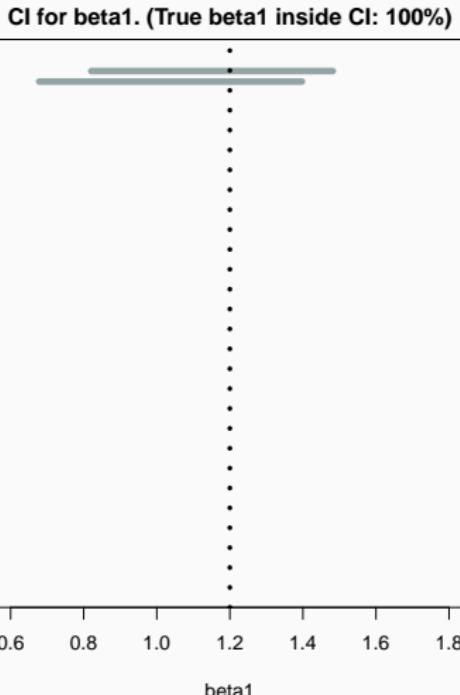
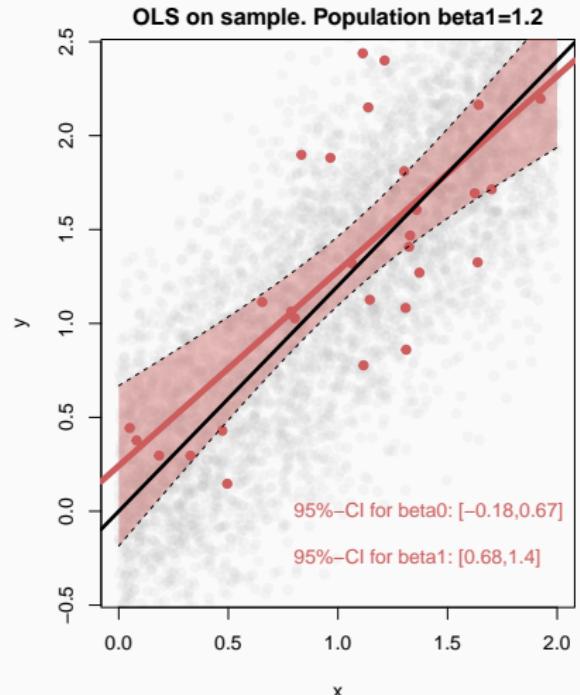
The CLT tells us that this RV converges to  $N(0, \sigma)$ .

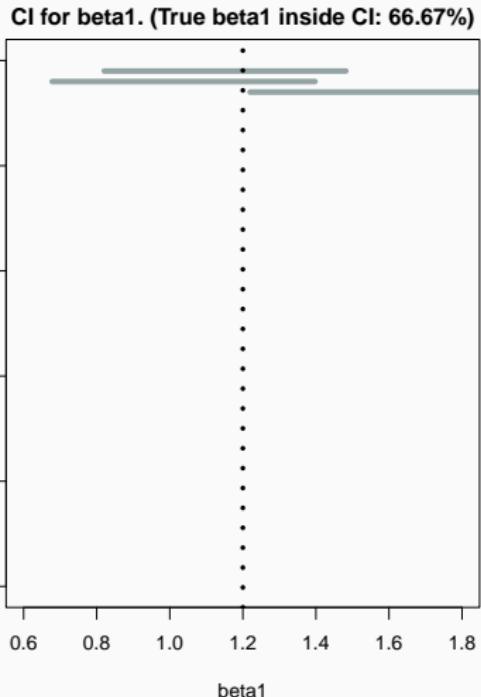
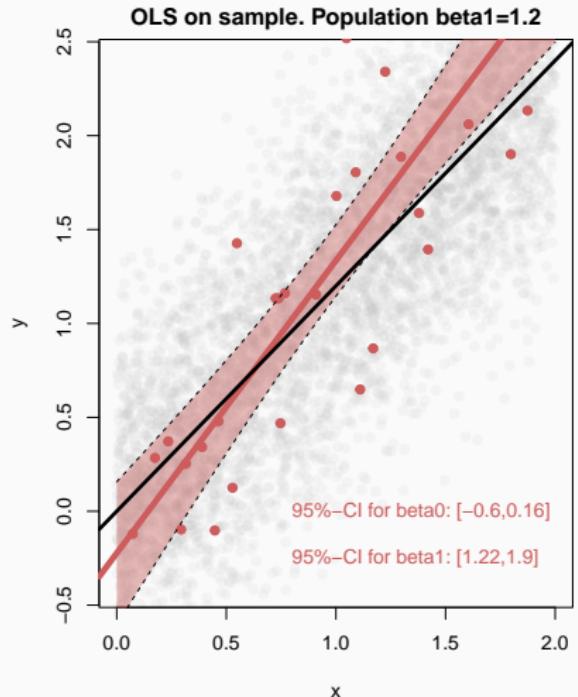


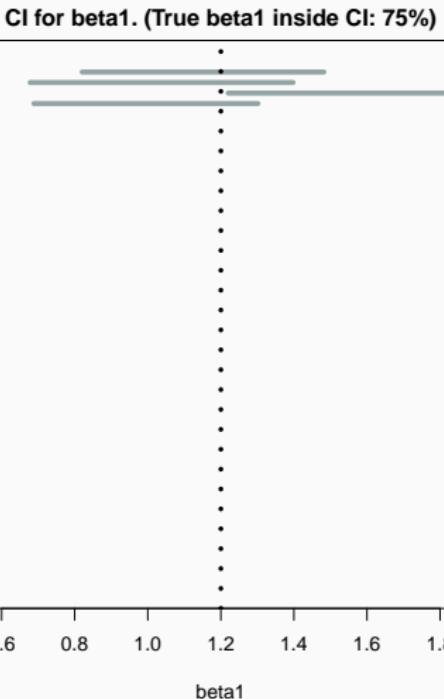
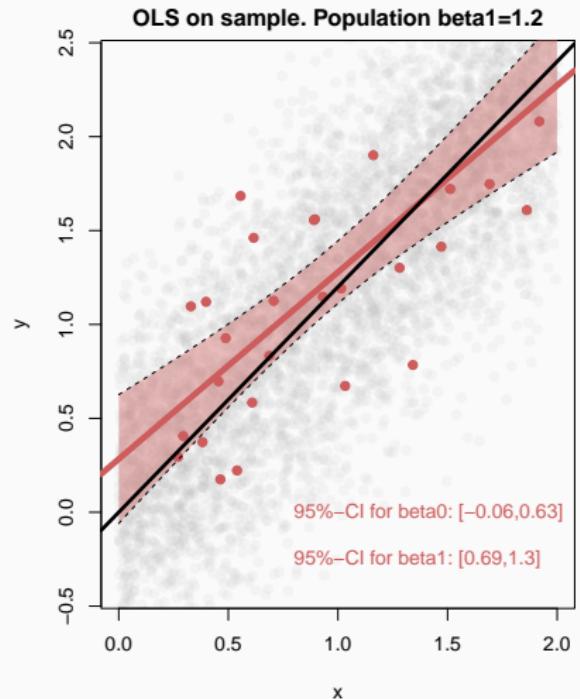
# **CIs**

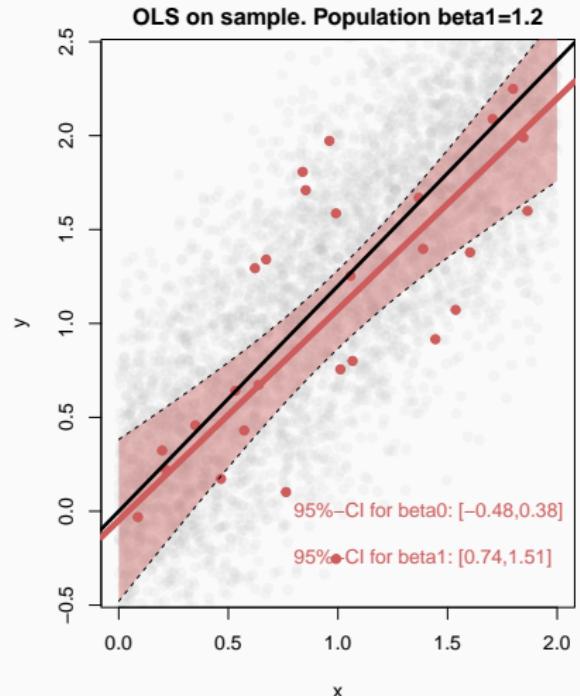
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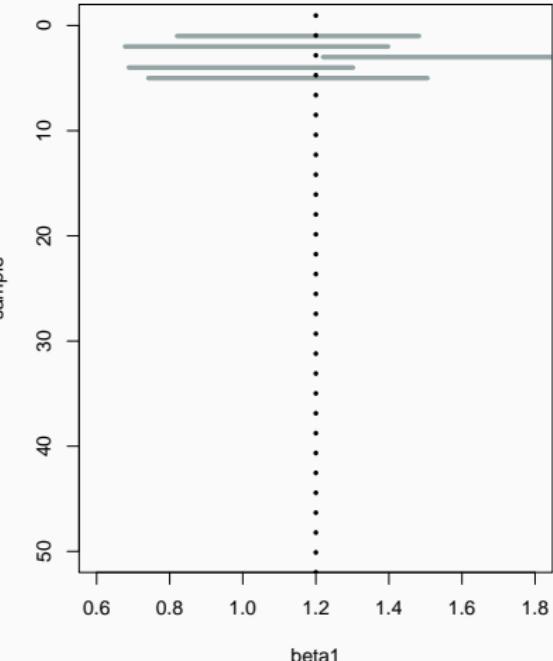


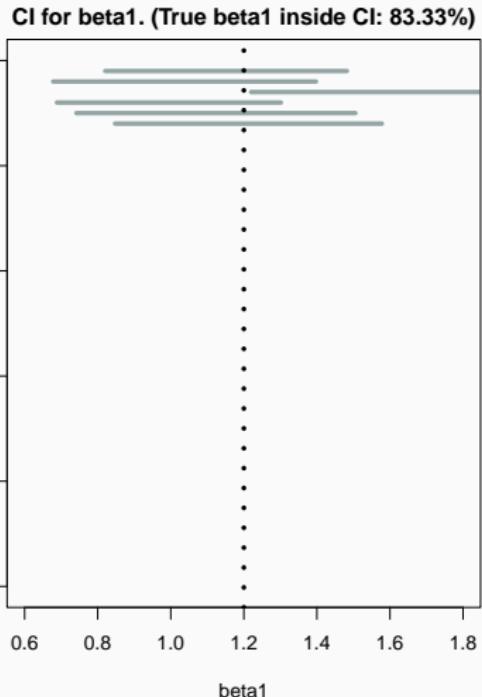
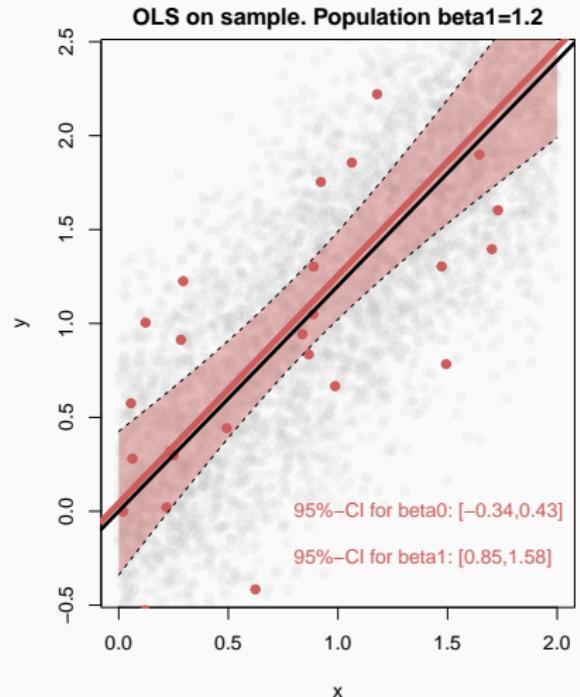


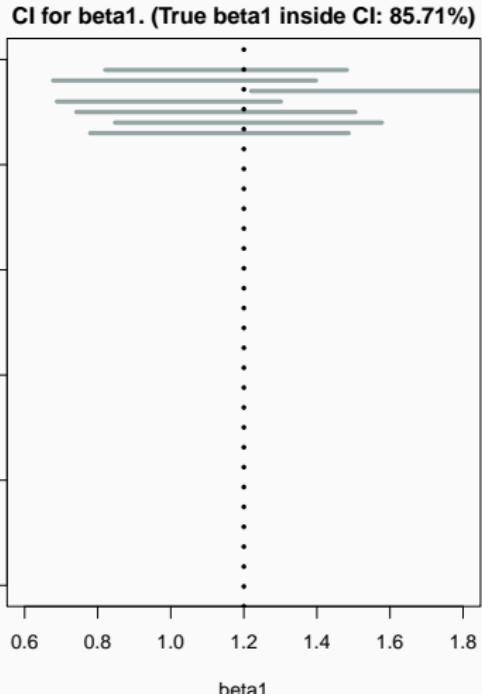
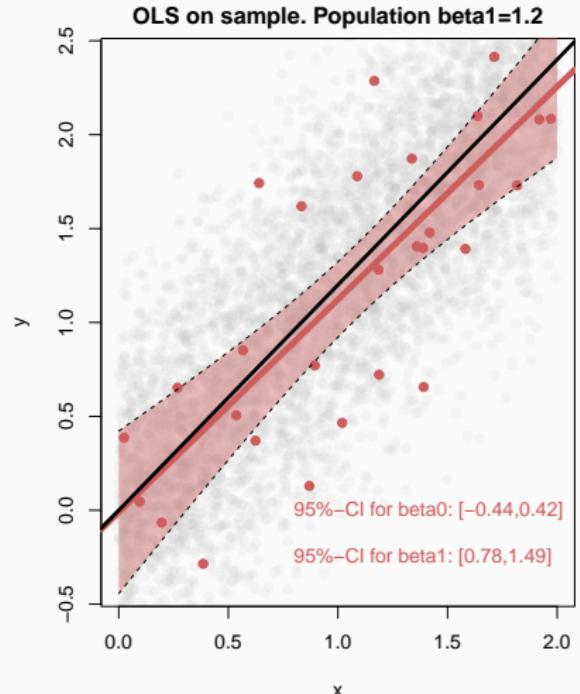


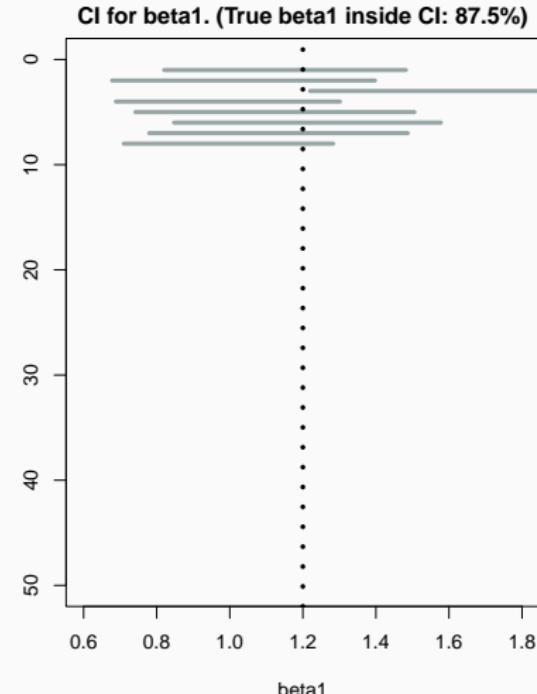
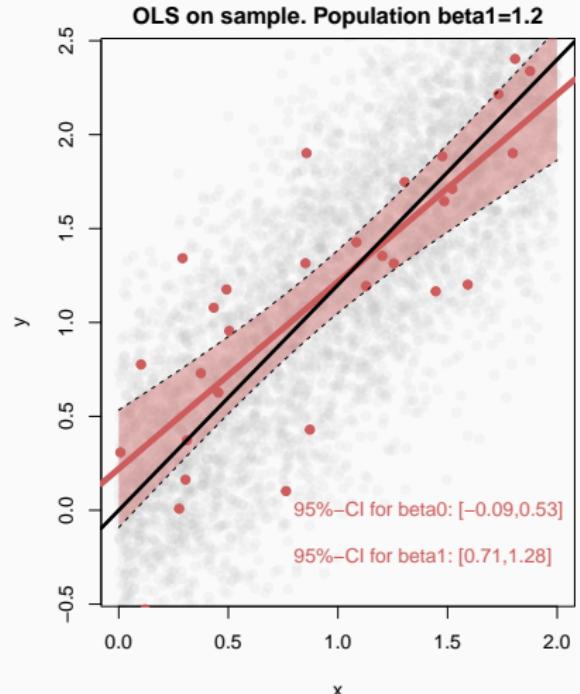


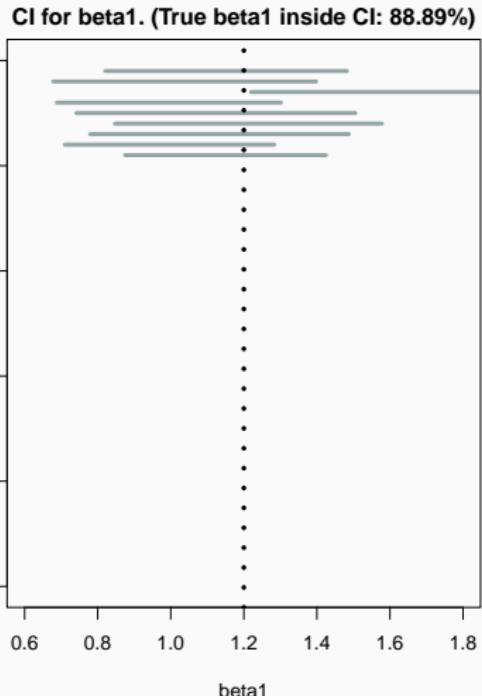
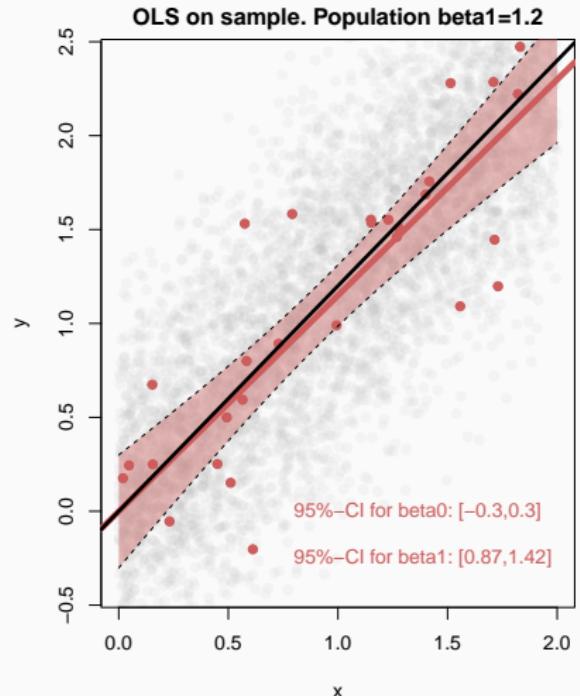
CI for beta1. (True beta1 inside CI: 80%)

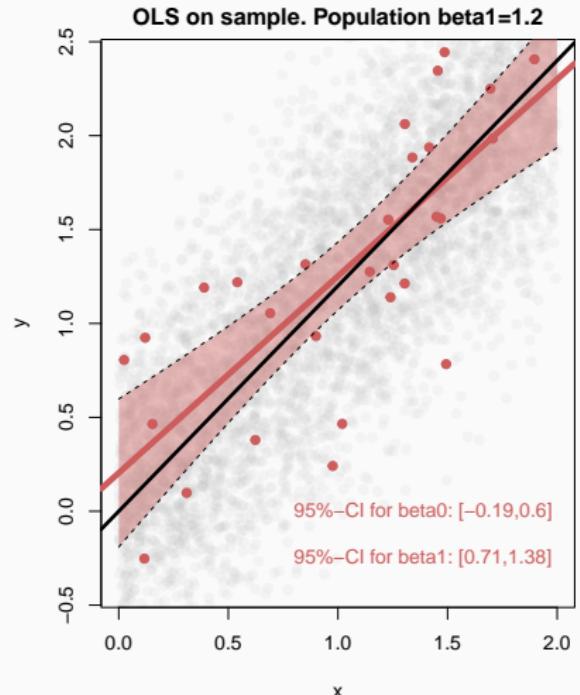




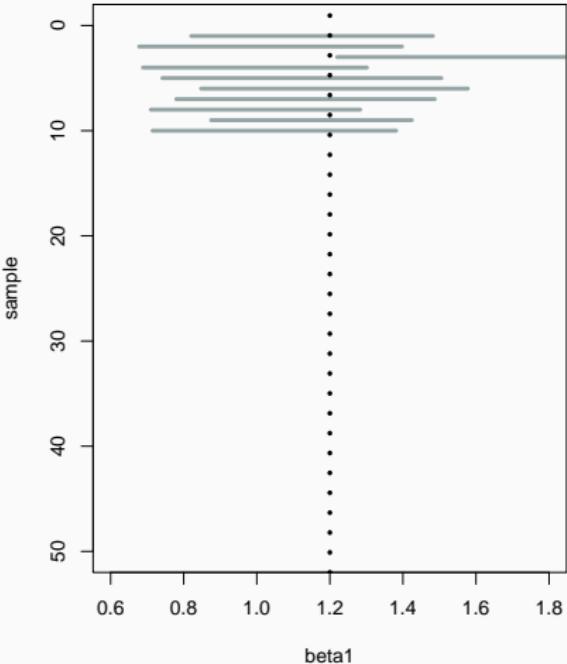








CI for beta1. (True beta1 inside CI: 90%)



# CIs

