

KidIQ: kidiq.csv

Widen the notebook.

```
• html"""
• <style>
•     main {
•         margin: 0 auto;
•         max-width: 2000px;
•         padding-left: max(160px, 10%);
•         padding-right: max(160px, 10%);
•     }
• </style>
• """
•
```

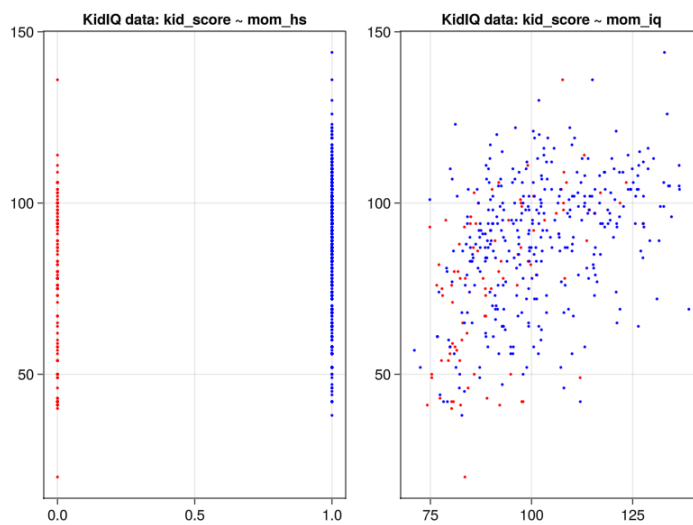
```
• using Pkg ✓ , DrWatson ✓
```

```
• begin
•     # Specific to ROSStanPluto
•     using StanSample ✓
•
•     # Graphics related
•     using GLMakie ✓
•
•     # Common data files and functions
•     using RegressionAndOtherStories ✓
• end
```

```
kidiq =
```

	kid_score	mom_hs	mom_iq	mom_work
1	65	1	121.118	4
2	98	1	89.3619	4
3	85	1	115.443	4
4	83	1	99.4496	3
5	115	1	92.7457	4
6	98	0	107.902	1
7	69	1	138.893	4
8	106	1	125.145	3
9	102	1	81.6195	1
10	95	1	95.0731	1
⋮ more				
434	70	1	91.2533	2

```
• kidiq = CSV.read(ros_datadir("KidIQ",  
"kidiq.csv"), DataFrame)
```



```

• let
•     f = Figure()
•     ax = Axis(f[1, 1]; title="KidIQ data:
•     kid_score ~ mom_hs")
•     scatter!(kidiq[kidiq.mom_hs .== 0,
•     :mom_hs], kidiq[kidiq.mom_hs .== 0,
•     :kid_score]; color=:red, markersize = 3)
•     scatter!(kidiq[kidiq.mom_hs .== 1,
•     :mom_hs], kidiq[kidiq.mom_hs .== 1,
•     :kid_score]; color=:blue, markersize =
•     3)
•     ax = Axis(f[1, 2]; title="KidIQ data:
•     kid_score ~ mom_iq")
•     scatter!(kidiq[kidiq.mom_hs .== 0,
•     :mom_iq], kidiq[kidiq.mom_hs .== 0,
•     :kid_score]; color=:red, markersize = 3)
•     scatter!(kidiq[kidiq.mom_hs .== 1,
•     :mom_iq], kidiq[kidiq.mom_hs .== 1,
•     :kid_score]; color=:blue, markersize =
•     3)
•     current_figure()
• end

```

```
• stan10_1 = "  
• data {  
•   int N;  
•   vector[N] mom_hs;  
•   vector[N] kid_score;  
• }  
• parameters {  
•   real a;  
•   real b;  
•   real sigma;  
• }  
• model {  
•   vector[N] mu;  
•   a ~ normal(100, 10);  
•   b ~ normal(5, 10);  
•   mu = a + b * mom_hs;  
•   kid_score ~ normal(mu, sigma);  
• }  
• ";
```

	parameters	mean	mcse	std	
1	"a"	78.7551	0.0493438	2.04287	7
2	"b"	10.5245	0.0555369	2.26707	6
3	"sigma"	19.9081	0.0149796	0.683178	1

```

• let
•   data=(N = nrow(kidiq), mom_hs =
•     kidiq.mom_hs, mom_iq = kidiq.mom_iq,
•     kid_score = kidiq.kid_score)
•   global m10_1s = SampleModel("m10.1s",
•     stan10_1)
•   global rc10_1s = stan_sample(m10_1s;
•     data)
•   success(rc10_1s) && describe(m10_1s)
end

```

```

/
e
Informational Message: The current Metropolis
rejected because of the following issue:
Exception: normal_lpdf: Scale parameter is -41
(in '/var/folders/l7/pr04h0650q5dvqtnvs8s2c0
n', line 16, column 1 to column 31)
If this warning occurs sporadically, such as f
types like covariance matrices, then the sampl
but if this warning occurs often then your mod
conditioned or misspecified.

Informational Message: The current Metropolis
ed because of the following issue:
Exception: normal_lpdf: Scale parameter is -58
(in '/var/folders/l7/pr04h0650q5dvqtnvs8s2c0
n', line 16, column 1 to column 31)
If this warning occurs sporadically, such as f
types like covariance matrices, then the sampl
but if this warning occurs often then your mod
conditioned or misspecified.

Informational Message: The current Metropolis
ed because of the following issue:
Exception: normal_lpdf: Scale parameter is -43
(in '/var/folders/l7/pr04h0650q5dvqtnvs8s2c0
n', line 16, column 1 to column 31)
If this warning occurs sporadically, such as f
types like covariance matrices, then the sampl
but if this warning occurs often then your mod
conditioned or misspecified.

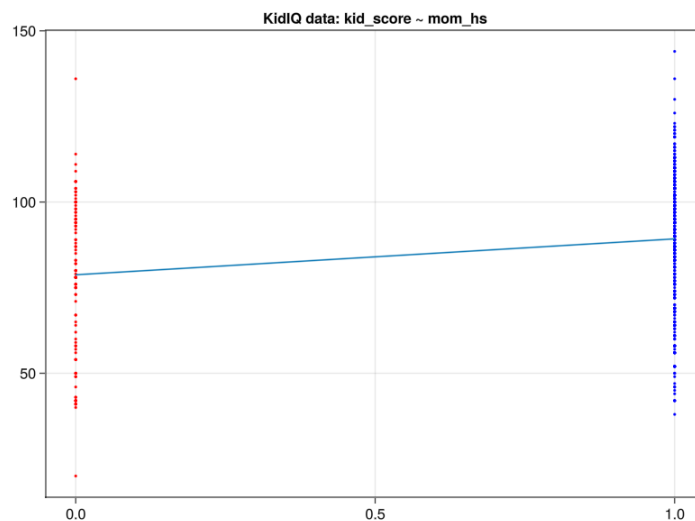
```

	parameters	median	mad_sd	mean	std
1	"a"	78.759	2.065	78.755	2.04
2	"b"	10.49	2.255	10.525	2.26
3	"sigma"	19.898	0.681	19.908	0.68

```

• if success(rc10_1s)
•     post10_1s = read_samples(m10_1s,
•                             :dataframe)
•     ms10_1s = model_summary(post10_1s, [:a,
•                                         :b, :sigma])
end

```



```

• let
•     f = Figure()
•     ax = Axis(f[1, 1]; title="KidIQ data:
•         kid_score ~ mom_hs")
•     scatter!(kidiq[kidiq.mom_hs .== 0,
•                   :mom_hs], kiddi[kidiq.mom_hs .== 0,
•                   :kid_score]; color=:red, markersize = 3)
•     scatter!(kidiq[kidiq.mom_hs .== 1,
•                   :mom_hs], kiddi[kidiq.mom_hs .== 1,
•                   :kid_score]; color=:blue, markersize =
•     3)
•     lines!([0.0, 1.0], [ms10_1s[:a,
•                               :median], ms10_1s[:a, :median] +
•                               ms10_1s[:b, :median]])
•     current_figure()
end

```

```

• stan10_2 = "
• data {
•   int N;
•   vector[N] mom_iq;
•   vector[N] kid_score;
• }
• parameters {
•   real a;
•   real b;
•   real sigma;
• }
• model {
•   vector[N] mu;
•   a ~ normal(25, 3);
•   b ~ normal(1, 2);
•   mu = a + b * mom_iq;
•   kid_score ~ normal(mu, sigma);
• }
• ";

```

	parameters	mean	mcse	std
1	"a"	25.0983	0.064798	2.62399
2	"b"	0.61675	0.000669519	0.0270064
3	"sigma"	18.2847	0.0143149	0.621135

```

• let
•   data=(N = nrow(kidiq), mom_hs =
•     kidiq.mom_hs, mom_iq = kidiq.mom_iq,
•     kid_score = kidiq.kid_score)
•   global m10_2s = SampleModel("m10.2s",
•     stan10_2)
•   global rc10_2s = stan_sample(m10_2s;
•     data)
•   success(rc10_2s) && describe(m10_2s)
• end

```

/var/folders/l7/pr04h0650q5dvqtttnvs8s2c00000gn/T/ed.

	a	b	sigma
1	25.1693	0.623779	18.4809
2	24.1716	0.63411	18.9702
3	26.3611	0.603176	17.8014
4	26.9449	0.590365	18.7908
5	22.7163	0.64266	18.454
6	22.1223	0.634803	18.502
7	22.865	0.634763	17.4406
8	22.7234	0.647194	17.3998
9	21.6213	0.65031	19.3047
10	21.5567	0.652588	19.3524
: more			
4000	24.8714	0.636596	18.6827

```

• if success(rc10_2s)
•   post10_2s = read_samples(m10_2s,
•                             :dataframe)
• end

```

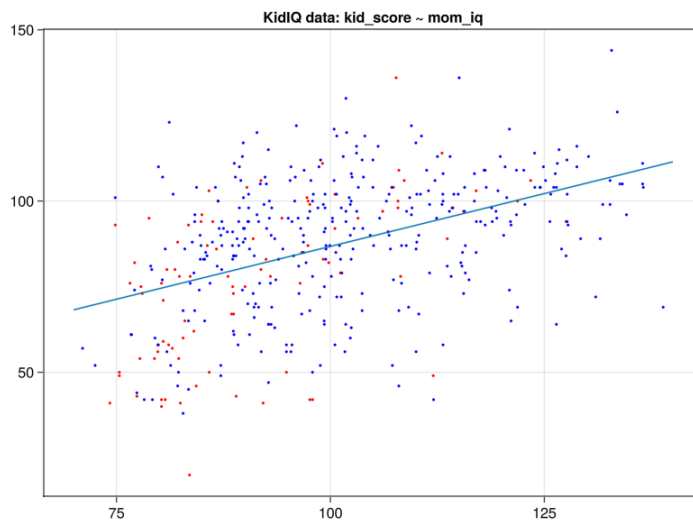
ms10_2s =

	parameters	median	mad_sd	mean	st
1	"a"	25.058	2.637	25.098	2.62
2	"b"	0.617	0.027	0.617	0.02
3	"sigma"	18.269	0.614	18.285	0.62

```

• ms10_2s = success(rc10_2s) &&
  model_summary(post10_2s, [:a, :b, :sigma])

```

```

let
  f = Figure()
  ax = Axis(f[1, 1]; title="KidIQ data:
  kid_score ~ mom_iq")
  scatter!(kidiq[kidiq.mom_hs .== 0,
  :mom_iq], kidiq[kidiq.mom_hs .== 0,
  :kid_score]; color=:red, markersize = 3)
  scatter!(kidiq[kidiq.mom_hs .== 1,
  :mom_iq], kidiq[kidiq.mom_hs .== 1,
  :kid_score]; color=:blue, markersize =
  3)
  x = LinRange(70.0, 140.0, 100)
  lines!(x, ms10_2s[:a, :median] .+
  ms10_2s[:b, :median] .* x)
  current_figure()
end

```

```

• stan10_3 = "
• data {
•   int N;
•   vector[N] mom_hs;
•   vector[N] mom_iq;
•   vector[N] kid_score;
• }
• parameters {
•   real a;
•   real b;
•   real c;
•   real sigma;
• }
• model {
•   vector[N] mu;
•   a ~ normal(25, 2);
•   b ~ normal(5, 2);
•   c ~ normal(1, 2);
•   mu = a + b * mom_hs + c * mom_iq;
•   kid_score ~ normal(mu, sigma);
• }
• ";

```

	parameters	mean	mcse	std
1	"a"	25.0901	0.0390298	1.87419
2	"b"	5.41651	0.0275519	1.46129
3	"c"	0.574228	0.000512244	0.023534
4	"sigma"	18.1529	0.011676	0.6246

```

• begin
•   data10_3 = (N = nrow(kidiq), mom_hs =
•     kidiq.mom_hs, mom_iq = kidiq.mom_iq,
•     kid_score = kidiq.kid_score)
•   global m10_3s = SampleModel("m10.3s",
•     stan10_3)
•   global rc10_3s = stan_sample(m10_3s;
•     data= data10_3)
•     success(rc10_3s) && describe(m10_3s)
• end

```

/var/folders/l7/pr04h0650q5dvqtttnvs8s2c00000gn/T/ed.

post10_3s =

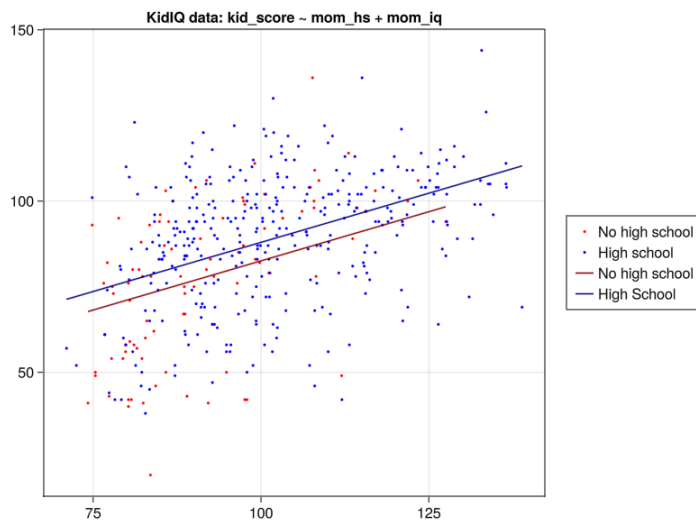
	a	b	c	sigma
1	25.0364	5.55362	0.576097	18.557
2	26.7192	5.79785	0.558495	17.7402
3	24.9297	5.12184	0.576571	18.4988
4	26.4043	4.75753	0.565424	17.994
5	24.5457	6.71568	0.568984	18.1171
6	27.6744	4.30833	0.556419	18.2424
7	27.6403	5.20548	0.560409	18.0923
8	20.9166	5.01732	0.628049	18.1075
9	21.0869	4.33545	0.62115	17.9952
10	20.6196	5.85022	0.608106	18.1606
⋮ more				
4000	27.1917	7.57657	0.53501	17.6077

- `post10_3s = read_samples(m10_3s, :dataframe)`

ms10_3s =

	parameters	median	mad_sd	mean	std
1	"a"	25.13	1.878	25.09	1.87
2	"b"	5.405	1.452	5.417	1.46
3	"c"	0.574	0.024	0.574	0.02
4	"sigma"	18.147	0.63	18.153	0.62

- `ms10_3s = model_summary(post10_3s, [:a, :b, :c, :sigma])`



```

let
  momnohs(x) = x == 0
  nohs = findall(momnohs, kidiq.mom_hs)

  momhs(x) = x == 1
  hs = findall(momhs, kidiq.mom_hs)

  f = Figure()
  ax = Axis(f[1, 1]; title="KidIQ data:
  kid_score ~ mom_hs + mom_iq")
  sca1 = scatter!(kidiq[kidiq.mom_hs .==
  0, :mom_iq], kidiq[kidiq.mom_hs .== 0,
  :kid_score]; color=:red, markersize = 3)
  sca2 = scatter!(kidiq[kidiq.mom_hs .==
  1, :mom_iq], kidiq[kidiq.mom_hs .== 1,
  :kid_score]; color=:blue, markersize =
  3)
  x = sort(kidiq.mom_iq[nohs])
  lin1 = lines!(x, ms10_3s[:a, :median] .+
  ms10_3s[:b, :median] .*
  kidiq.mom_hs[nohs] .+ ms10_3s[:c,
  :median] .* x;
  color=:darkred)
  x = sort(kidiq.mom_iq[hs])
  lin2 = lines!(x, ms10_3s[:a, :median] .+
  ms10_3s[:b, :median] .*
  kidiq.mom_hs[hs] .+ ms10_3s[:c,
  :median] .* x;
  color=:darkblue)
  Legend(f[1, 2],
  [sca1, sca2, lin1, lin2],
  ["No high school", "High school",
  "No high school", "High School"])
  current_figure()
end

```

