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 ✓
```

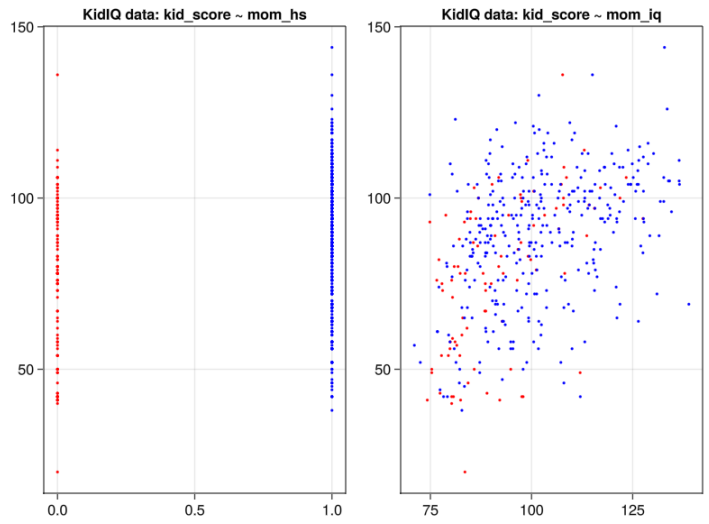
```
begin
    # Specific to ROSStanPluto
    using StanSample ✓

    # Graphics related
    using GLMakie ✓

    # Common data files and functions
    using RegressionAndOtherStories ✓
end
```

```
Replacing docs for `RegressionAndOtherStories.tr
DataFrame, AbstractString}` in module `Regressio
```

```
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"	78.6859	0.0536724	2.06308	7
2	"b"	10.5669	0.0602408	2.28715	6
3	"sigma"	19.9345	0.0140919	0.676563	1

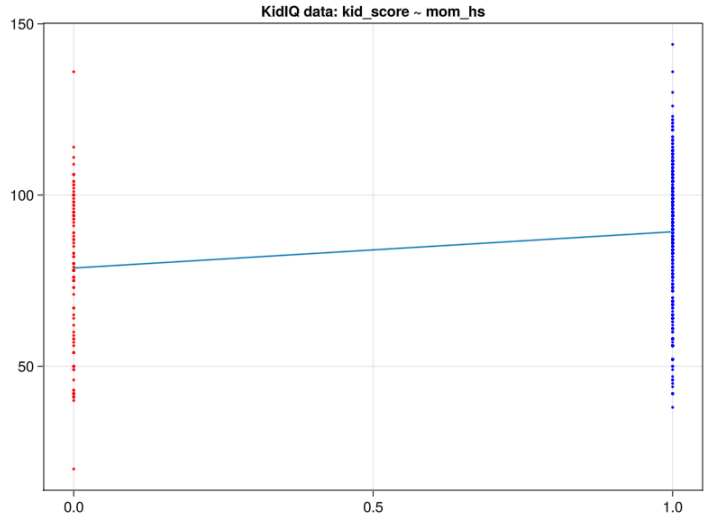
```
let
    data =(N = nrow(kidiq), mom_hs =
    kidiq.mom_hs, mom_iq = kidiq.mom_iq,
    kid_score = kidiq.kid_score)
    global m10_1s = SampleModel("m10.1s",
    stan10_1)
    global rc10_1s = stan_sample(m10_1s;
    data)
    success(rc10_1s) && describe(m10_1s)
end
```

```
Informational Message: The current Metropolis
jected because of the following issue:
Exception: normal_lpdf: Scale parameter is -25
 (in '/var/folders/l7/pr04h0650q5dvqttnvs8s2c0
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 -61
 (in '/var/folders/l7/pr04h0650q5dvqttnvs8s2c0
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 -40
 (in '/var/folders/l7/pr04h0650q5dvqttnvs8s2c0
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 -7.
 (in '/var/folders/l7/pr04h0650q5dvqttnvs8s2c0
```

```
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 -2.
n '/var/folders/l7/pr04h0650q5dvqttnvs8s2c0000
 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 -3.
 (in '/var/folders/l7/pr04h0650q5dvqttnvs8s2c0
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	st
1	"a"	78.691	2.074	78.686	2.06
2	"b"	10.589	2.313	10.567	2.28
3	"sigma"	19.906	0.693	19.934	0.67

```
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], 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)
    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"	25.1104	0.0698964	2.72482
2	"b"	0.616762	0.00071577	0.028129
3	"sigma"	18.2881	0.013591	0.620135

```
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
```

```
Informational Message: The current Metropolis
jected because of the following issue:
Exception: normal_lpdf: Scale parameter is -30
 (in '/var/folders/l7/pr04h0650q5dvqttnvs8s2c0
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.
```

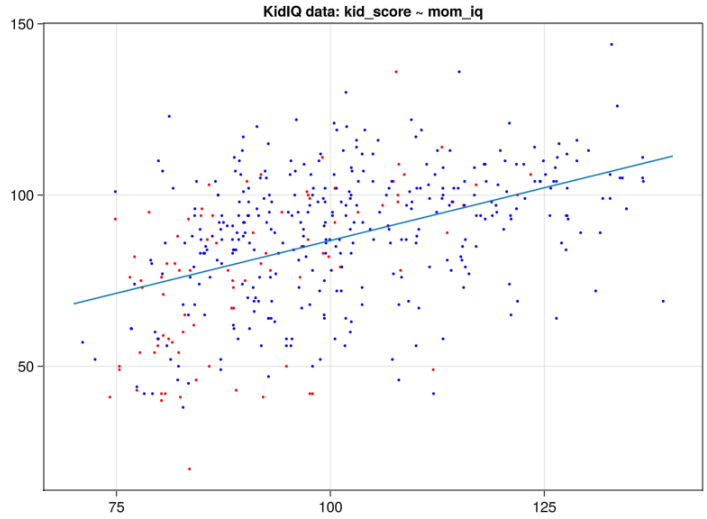
	a	b	sigma
1	21.0721	0.65748	17.618
2	20.79	0.651571	17.7045
3	24.7849	0.62451	17.8269
4	22.2028	0.64766	18.5359
5	26.9223	0.600813	18.4712
6	26.5473	0.595209	18.7225
7	28.3109	0.598229	17.9033
8	26.5793	0.589748	17.8456
9	28.1718	0.587468	18.3573
10	28.4261	0.573465	19.0671
⋮ more			
4000	25.0266	0.632359	19.6221

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

```
ms10_2s =
```

	parameters	median	mad_sd	mean	st
1	"a"	25.124	2.729	25.11	2.72
2	"b"	0.616	0.028	0.617	0.02
3	"sigma"	18.286	0.62	18.288	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"	25.1309	0.0395119	1.92925
2	"b"	5.42713	0.0299104	1.49933
3	"c"	0.573788	0.000534149	0.024136
4	"sigma"	18.1435	0.0103182	0.600691

```
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/pr04h0650q5dvqttnvs8s2c00000gn/T
ed.
```

post10_3s =

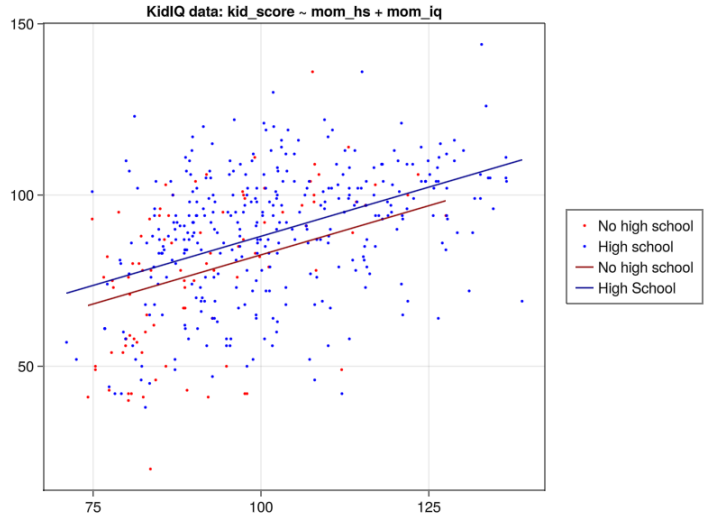
	a	b	c	sigma
1	26.3128	6.20319	0.553104	17.7257
2	26.6021	7.33213	0.551209	16.5375
3	25.2281	6.69903	0.551072	19.8148
4	28.4939	5.19491	0.549781	17.7873
5	28.089	4.95956	0.549405	17.9181
6	29.3446	4.8132	0.532477	18.5093
7	23.2143	7.26116	0.576114	17.7145
8	25.3755	6.3087	0.574949	18.1304
9	26.4275	4.08918	0.559029	18.736
10	26.7288	6.13821	0.538657	18.3891
⋮	more			
4000	24.7389	7.05288	0.556807	17.6545

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

ms10_3s =

	parameters	median	mad_sd	mean	st
1	"a"	25.141	1.95	25.131	1.92
2	"b"	5.423	1.494	5.427	1.49
3	"c"	0.574	0.024	0.574	0.02
4	"sigma"	18.127	0.612	18.144	0.60

```
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
```