

Ch7 - Ex2 - USA Crime Rate (*crime*) by State

Per Cent Metro (*met*), White (*wh*), High School (*hs*), Poverty (*pv*), Single Parent (*sp*)

CORR crime TO sp /STAT /MISS = LIST.

	Mean	Std. Deviation	N
Y crime	572.90	295.603	49
X1 met	66.5755	21.86913	49
wh	86.0653	9.12696	49
hs	76.2082	5.66197	49
pv	14.1388	4.24135	49
sp	11.1510	1.46132	49

$SS_Y = 4,194,294.41$

	crime	met	wh	hs	pv
met	.610				
	.000				
wh	$r_{Y1} = -0.684$	-.293			
	.000	.041			
hs	-.287	.008	.508		
	.046	.956	.000		
pv	.350	-.148	-.434	-.773	
	.014	.310	.002	.000	
sp	.639	.171	-.686	-.222	.407
	.000	.239	.000	.125	.004

REGRESS /DEP = crime /ENTER met TO sp /SAVE PRED(prdc.mwhps) RESID(resc.mwhps)

Model	R	R Square
1	.867	.751

$\frac{SS_A}{SS_Y}$

$\frac{SS}{df}$ $\frac{MS_{reg}}{MS_{res}}$

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	SS_A 3151553.947	P 5	630310.789	25.993	.000
	Residual	$SS_Y - A$ 1042736.542	n-p-1 43	24249.687		
	Total	4194290.490	48			

Reg $H_0: \beta_{c.mwhps} = 0$

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	-599.782	656.310			-.914	.366
	met	7.090	1.137	.525		6.234	.000
	wh	-10.125	4.193	-.313		-2.415	.020
	hs	9.265	7.425	.177		1.248	.219
	pv	23.113	9.719	.332		2.378	.022
	sp	48.353	24.191	.239		1.999	.052

VS .000 for r_{cw}

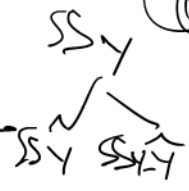


	Mean	Std. Deviation	N
Predicted Value	572.90	256.237	49
Residual	.000	147.390	49

$$SS_y = 3,151,555.21$$

$$SS_{y-hat} = 1,042,742.98$$

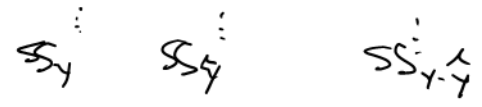
$$SS_y - SS_{y-hat} = 2,108,812.23$$



```
VARIABLE LABEL prdc.mwhps ' ' resc.mwhps ' '.
LIST met TO sp crime prdc.mwhps resc.mwhps /CASES = FROM 1 TO 5.
```

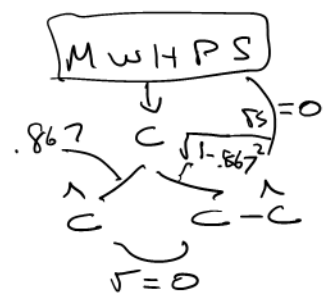
$$\hat{Y} = -599.782 + 7.090x_{met} - 10.125x_{wh} + 9.265x_{hs} + 23.113x_{pv} + 48.353x_{sp}$$

	met	wh	hs	pv	sp	crime	prdc.mwhps	resc.mwhps
41.80	75.20	86.60	9.10	14.30	761	639.32585	121.67415	
67.40	73.50	66.90	17.40	11.50	780	711.97953	68.02047	
44.70	82.90	66.30	20.00	10.70	593	471.70047	121.29953	
84.70	88.60	78.70	15.40	12.10	715	773.86900	-58.86900	
96.70	79.30	76.20	18.20	12.50	1078	1014.01429	63.98571	



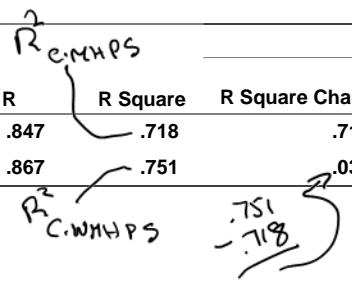
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CORR prdc.mwhps resc.mwhps WITH crime TO sp /MISS = LIST.
```

	crime	met	wh	hs	pv	sp
prdc.mwhps	.867	.703	-.789	-.331	.403	.737
resc.mwhps	.499	.000	.000	.000	.000	.000



```
REGRESS /STAT = DEFAU CHANGE ZPP /DEP = crime /ENTER met hs TO sp /ENTER wh.
```

Model	Change Statistics						
	R	R Square	R Square Change	F Change	df1	df2	Sig. F Change
1	.847	.718	.718	27.962	4	44	.000
2	.867	.751	.034	5.832	1	43	.020



$$F_{ch} = \frac{14145.334}{1}{24249.687} = 5.832$$

$H_0: \rho_{C(W.MHPS)} = 0$
 $H_a: \rho > < ?$

$$\sqrt{5.832} = 2.415 = t$$

$$SS_{E, W.MHPS} = 3151553.947 - 3010138.613 = 141415.334$$

$$R^2_{C(W.MHPS)} = \frac{141415.334}{SS_Y} = .034 \quad \sqrt{} = .184$$

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3010138.613	4	752534.653	27.962	.000
	Residual	1184151.877	44	26912.543		
	Total	4194290.490	48			
2	Regression	3151553.947	5	630310.789	25.993	.000
	Residual	1042736.542	43	24249.687		
	Total	4194290.490	48			

Model		Unstandardized Coefficients				Correlations		
		B	Std. Error	t	Sig.	Zero-order	Partial	Part
1	(Constant)	-1233.679	633.697	-1.947	.058			
	met	7.766	1.161	6.687	.000	.610	.710	.536
	hs	.613	6.852	.089	.929	-.287	.013	.007
	pv	18.626	10.049	1.853	.071	.350	.269	.148
	sp	87.837	18.782	4.677	.000	.639	.576	.375
2	(Constant)	-599.782	656.310	-.914	.366			
	met	7.090	1.137	6.234	.000	.610	.689	.474
	hs	9.265	7.425	1.248	.219	-.287	.187	.095
	pv	23.113	9.719	2.378	.022	.350	.341	.181
	sp	48.353	24.191	1.999	.052	.639	.292	.152
	wh	-10.125	4.193	-2.415	.020	-.684	-.346	-.184

$$SE = \sqrt{\frac{MS_{RES 2}}{SS_W(1-R^2_{W.MHPS})}} = \sqrt{\frac{24249.687}{1379.378}}$$

REGRESS /DEP = wh /ENTER met hs TO sp /SAVE RES(resw.mhps).

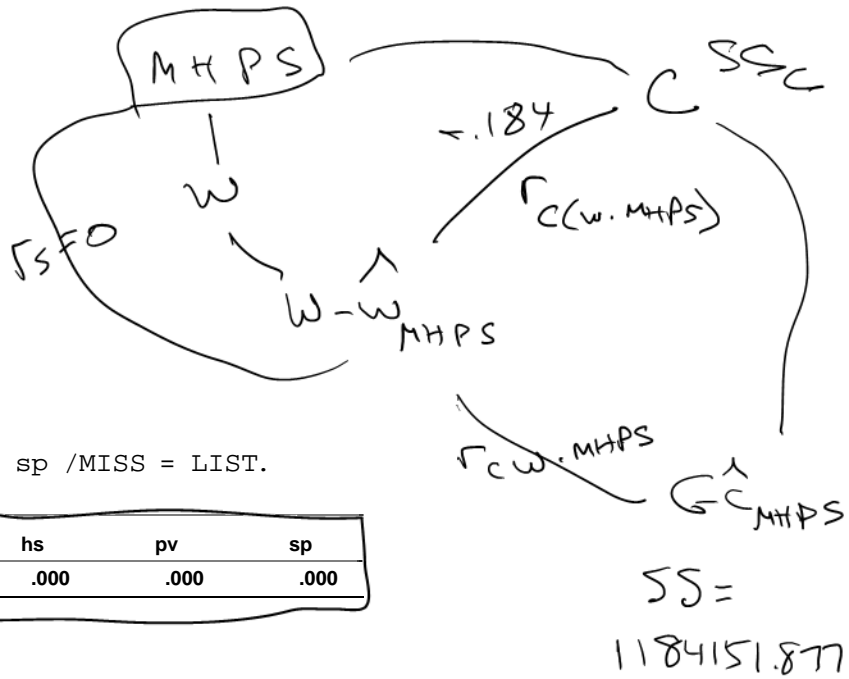
Model	R	R Square
1	.809	.655

$R^2_{W.MHPS}$

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2619.093	4	654.773	20.886	.000
	Residual	$SS_W(1-.655) = 1379.378$	44	31.349		
	Total	SS_W 3998.471	48			

Model		Unstandardized Coefficients			
		B	Std. Error	t	Sig.
1	(Constant)	62.605	21.628	2.895	.006
	met	-.067	.040	-1.684	.099
	hs	.855	.234	3.654	.001
	pv	.443	.343	1.292	.203
	sp	-3.900	.641	-6.083	.000

	Mean	Std. Deviation
Predicted Value	86.0653	7.38677
Residual	.00000	5.36069



VARIABLE LABELS resw.mhps ''.
 CORR resw.mhps WITH crime met hs TO sp /MISS = LIST.

	crime	met	hs	pv	sp
resw.mhps	-.184	.000	.000	.000	.000

REGRESS /VARIABLES = crime TO sp /DEPENDENT = crime /METHOD = FORWARD.

Model	Variables Entered	Variables Removed	Method
1	wh	.	Forward (Criterion: Probability-of-F-to-enter <= .050)
2	met	.	Forward (Criterion: Probability-of-F-to-enter <= .050)
3	sp	.	Forward (Criterion: Probability-of-F-to-enter <= .050)
4	pv	.	Forward (Criterion: Probability-of-F-to-enter <= .050)

Model	R	R Square
1	.684	.468
2	.807	.651
3	.845	.714
4	.862	.742

$$r_{cw} = .684 > r_{cm}, r_{ch}, \dots$$

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1963225.968	1	1963225.968	41.358	.000
	Residual	2231064.522	47	47469.458		
	Total	4194290.490	48			
2	Regression	2730634.136	2	1365317.068	42.909	.000
	Residual	1463656.354	46	31818.616		
	Total	4194290.490	48			
3	Regression	2995934.204	3	998644.735	37.501	.000
	Residual	1198356.286	45	26630.140		
	Total	4194290.490	48			
4	Regression	3113797.751	4	778449.438	31.700	.000
	Residual	1080492.739	44	24556.653		
	Total	4194290.490	48			

Model		Unstandardized Coefficients			Sig.
		B	Std. Error	t	
1	(Constant)	2479.966	298.172	8.317	.000
	wh	-22.158	3.446	-6.431	.000
2	(Constant)	1711.731	289.939	5.904	.000
	wh	-17.910	2.951	-6.070	.000
	met	6.047	1.231	4.911	.000
3	(Constant)	251.199	533.364	.471	.640
	wh	-10.122	3.657	-2.768	.008
	met	6.199	1.128	5.497	.000
	sp	69.964	22.166	3.156	.003
4	(Constant)	-129.886	540.911	-.240	.811
	wh	-7.601	3.696	-2.057	.046
	met	6.993	1.142	6.124	.000
	sp	62.351	21.568	2.891	.006
	pv	13.870	6.331	2.191	.034

see excl. model 1

see excl. 2

see excl. 3

Excluded Variables

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics	
						Tolerance	
1	met	.447	4.911	*.000	M+W	.586	.914
	hs	.082	.662	.511	H+W	.097	.742
	pv	.065	.544	.589	P+W	.080	.811
	sp	.320	2.288	.027	S+W	.320	.530
2	hs	-.013	-.125	.901	H+M+W	-.019	.715
	pv	.241	2.495	.016	P+M+W	.349	.728
	sp	.346	3.156	*.003	S+M+W	.426	.529
3	hs	-.080	-.830	.411	H+S+W	-.124	.682
	pv	.199	2.191	.034	P+S+W	.314	.709
4	hs	.177	1.248	.219		.187	.286

>.05

REGRESS /VARI = crime TO sp /DEP = crime /BACKWARD.

Model	Variables Entered	Variables Removed	Method
1	sp, met, hs, wh, pv	.	Enter
2		hs	Backward (criterion: Probability of F-to-remove >= .100).

Model	R	R Square
1	.867	.751
2	.862	.742

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3151553.947	5	630310.789	25.993	.000
	Residual	1042736.542	43	24249.687		
	Total	4194290.490	48			
2	Regression	3113797.751	4	778449.438	31.700	.000
	Residual	1080492.739	44	24556.653		
	Total	4194290.490	48			

Model		Unstandardized Coefficients			Sig.
		B	Std. Error	t	
1	(Constant)	-599.782	656.310	-.914	.366
	met	7.090	1.137	6.234	.000
	wh	-10.125	4.193	-2.415	.020
	hs	9.265	7.425	1.248	.219
	pv	23.113	9.719	2.378	.022
	sp	48.353	24.191	1.999	.052
2	(Constant)	-129.886	540.911	-.240	.811
	met	6.993	1.142	6.124	.000
	wh	-7.601	3.696	-2.057	.046
	pv	13.870	6.331	2.191	.034
	sp	62.351	21.568	2.891	.006

> .10

≤ .10

Excluded Variables

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
2	hs	.177	1.248	.219	.187	.286

REGRESS /VARI = crime TO sp /CRITERION = PIN(.035) POUT(.04) /DEP = crime /STEP

Model	Variables Entered	Variables Removed	Method
1	wh	.	Stepwise (Criteria: Probability-of-F-to-enter <= .035, Probability-of-F-to-remove >= .040).
2	met	.	Stepwise (Criteria: Probability-of-F-to-enter <= .035, Probability-of-F-to-remove >= .040).
3	sp	.	Stepwise (Criteria: Probability-of-F-to-enter <= .035, Probability-of-F-to-remove >= .040).
4	pv	.	Stepwise (Criteria: Probability-of-F-to-enter <= .035, Probability-of-F-to-remove >= .040).
5	.	wh	Stepwise (Criteria: Probability-of-F-to-enter <= .035, Probability-of-F-to-remove >= .040).

Model	R	R Square
1	.684	.468
2	.807	.651
3	.845	.714
4	.862	.742
5	.847	.718

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1963225.968	1	1963225.968	41.358	.000
	Residual	2231064.522	47	47469.458		
	Total	4194290.490	48			
2	Regression	2730634.136	2	1365317.068	42.909	.000
	Residual	1463656.354	46	31818.616		
	Total	4194290.490	48			
3	Regression	2995934.204	3	998644.735	37.501	.000
	Residual	1198356.286	45	26630.140		
	Total	4194290.490	48			
4	Regression	3113797.751	4	778449.438	31.700	.000
	Residual	1080492.739	44	24556.653		
	Total	4194290.490	48			
5	Regression	3009923.126	3	1003307.709	38.121	.000
	Residual	1184367.363	45	26319.275		
	Total	4194290.490	48			

Model		Unstandardized Coefficients			Sig.
		B	Std. Error	t	
1	(Constant)	2479.966	298.172	8.317	.000
	wh	-22.158	3.446	-6.431	.000
2	(Constant)	1711.731	289.939	5.904	.000
	wh	-17.910	2.951	-6.070	.000
	met	6.047	1.231	4.911	.000
3	(Constant)	251.199	533.364	.471	.640
	wh	-10.122	3.657	-2.768	.008
	met	6.199	1.128	5.497	.000
	sp	69.964	22.166	3.156	.003
4	(Constant)	-129.886	540.911	-.240	.811
	wh	-7.601	3.696	-2.057	.046
	met	6.993	1.142	6.124	.000
	sp	62.351	21.568	2.891	.006
	pv	13.870	6.331	2.191	.034
5	(Constant)	-1179.518	185.566	-6.356	.000
	met	7.743	1.120	6.913	.000
	sp	88.195	18.147	4.860	.000
	pv	17.925	6.229	2.878	.006

> .04

< .035

Excluded

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	met	.447	4.911	.000	.586	.914
	hs	.082	.662	.511	.097	.742
	pv	.065	.544	.589	.080	.811
	sp	.320	2.288	.027	.320	.530
2	hs	-.013	-.125	.901	-.019	.715
	pv	.241	2.495	.016	.349	.728
	sp	.346	3.156	.003	.426	.529
3	hs	-.080	-.830	.411	-.124	.682
	pv	.199	2.191	.034	.314	.709
4	hs	.177	1.248	.219	.187	.286
5	hs	.012	.089	.929	.013	.373
	wh	-.235	-2.057	.046	-.296	.450

```

DATA LIST FREE /id (F2.0) state (A2) crime (F4.0) met (F5.2) wh (F5.2) hs (F5.2) pv (F5.2) sp (F5.2).
BEGIN DATA
1 ak      761 41.80 75.20 86.60  9.10 14.30  2 al      780 67.40 73.50 66.90 17.40 11.50
3 ar      593 44.70 82.90 66.30 20.00 10.70  4 az      715 84.70 88.60 78.70 15.40 12.10
5 ca     1078 96.70 79.30 76.20 18.20 12.50  6 co      567 81.80 92.50 84.40  9.90 12.10
7 ct      456 95.70 89.00 79.20  8.50 10.10  8 de      686 82.70 79.40 77.50 10.20 11.40
9 fl     1206 93.00 83.50 74.40 17.80 10.60 10 ga     723 67.70 70.80 70.90 13.50 13.00
12 ia     326 43.80 96.60 80.10 10.30  9.00 13 id     282 30.00 96.70 79.70 13.10  9.50
14 il     960 84.00 81.00 76.20 13.60 11.50 15 in     489 71.60 90.60 75.60 12.20 10.80
16 ks     496 54.60 90.90 81.30 13.10  9.90 17 ky     463 48.50 91.80 64.60 20.40 10.60
18 la     1062 75.00 66.70 68.30 26.40 14.90 19 ma     805 96.20 91.10 80.00 10.70 10.90
20 md     998 92.80 68.90 78.40  9.70 12.00 21 me     126 35.70 98.50 78.80 10.70 10.60
22 mi     792 82.70 83.10 76.80 15.40 13.00 23 mn     327 69.30 94.00 82.40 11.60  9.90
24 mo     744 68.30 87.60 73.90 16.10 10.90 25 ms     434 30.70 63.30 64.30 24.70 14.70
26 mt     178 24.00 92.60 81.00 14.90 10.80 27 nc     679 66.30 75.20 70.00 14.40 11.10
28 nd      82 41.60 94.20 76.70 11.20  8.40 29 ne     339 50.60 94.30 81.80 10.30  9.40
30 nh     138 59.40 98.00 82.20  9.90  9.20 31 nj     627 100.00 80.80 76.70 10.90  9.60
32 nm     930 56.00 87.10 75.10 17.40 13.80 33 nv     875 84.80 86.70 78.80  9.80 12.40
34 ny     1074 91.70 77.20 74.80 16.40 12.70 35 oh     504 81.30 87.50 75.70 13.00 11.40
36 ok     635 60.10 82.50 74.60 19.90 11.10 37 or     503 70.00 93.60 81.50 11.80 11.30
38 pa     418 84.80 88.70 74.70 13.20  9.60 39 ri     402 93.60 92.60 72.00 11.20 10.80
40 sc     1023 69.80 68.60 68.30 18.70 12.30 41 sd     208 32.60 90.20 77.10 14.20  9.40
42 tn     766 67.70 82.80 67.10 19.60 11.20 43 tx     762 83.90 85.10 72.10 17.40 11.80
44 ut     301 77.50 94.80 85.10 10.70 10.00 45 va     372 77.50 77.10 75.20  9.70 10.30
46 vt     114 27.00 98.40 80.80 10.00 11.00 47 wa     515 83.00 89.40 83.80 12.10 11.70
48 wi     264 68.10 92.10 78.60 12.60 10.40 49 wv     208 41.80 96.30 66.00 22.20  9.40
50 wy     286 29.70 95.90 83.00 13.30 10.80
END DATA.

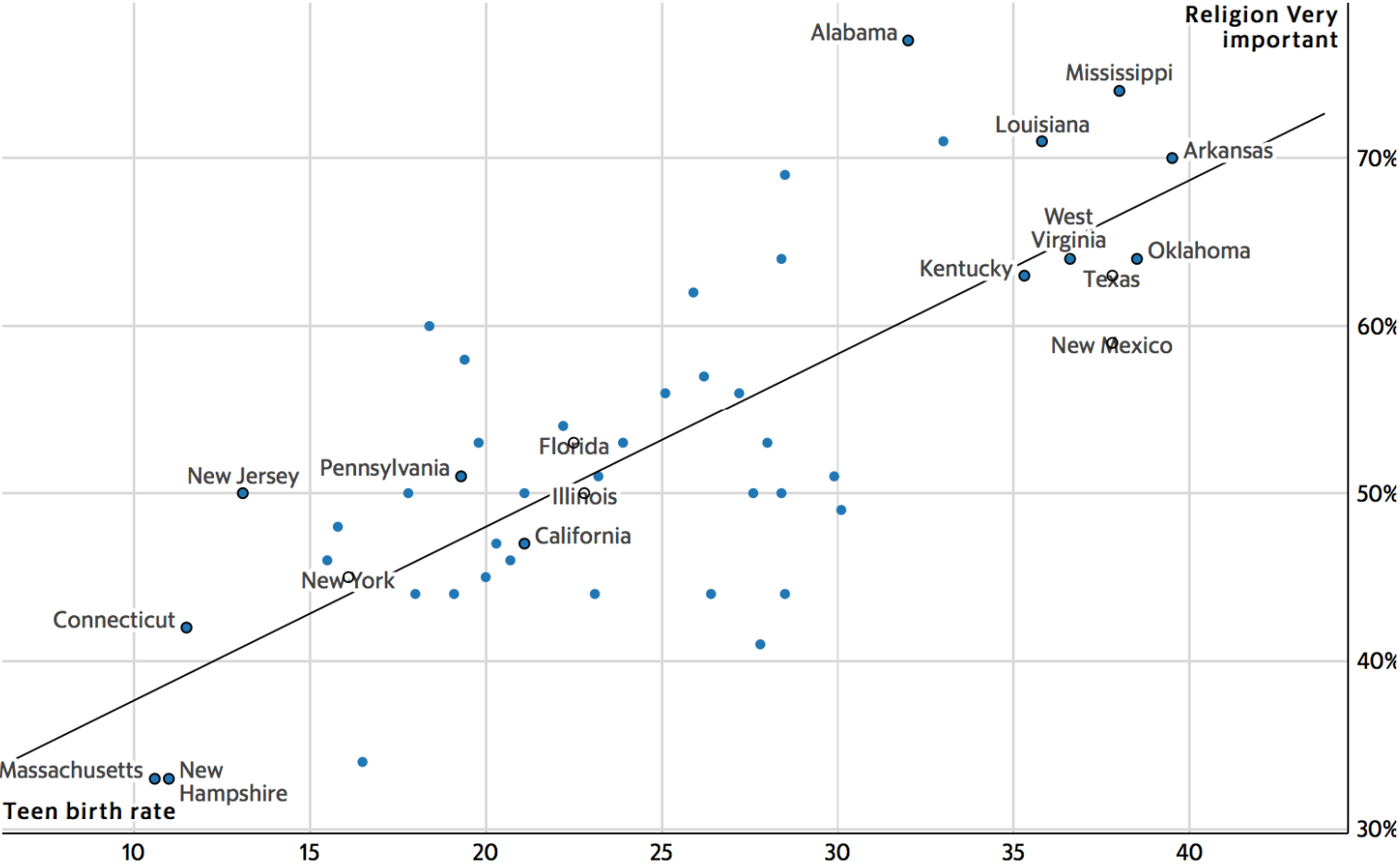
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Discussion

- other predictors?
- ecological corr. vs. individuals
- e.g. income & happiness
- teenage pregnancy & religion

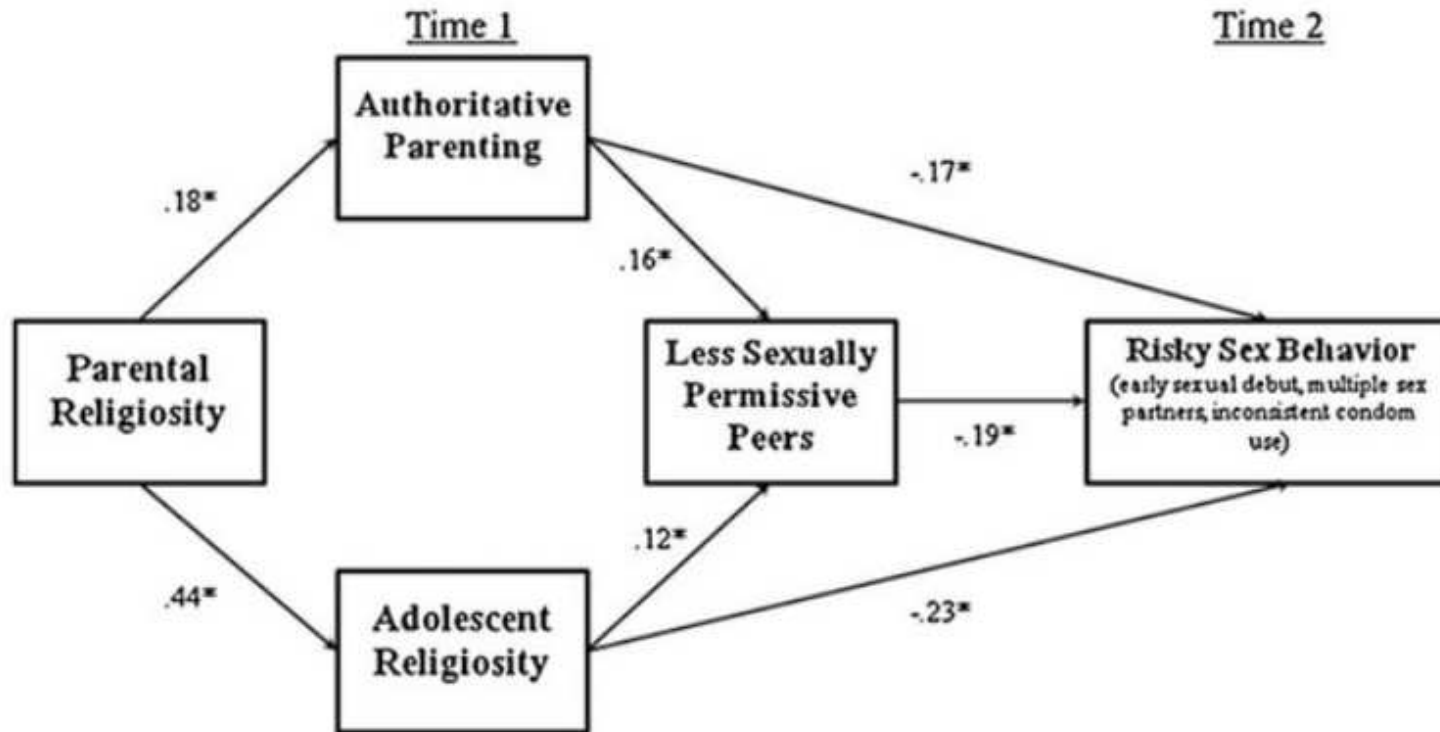
IMPORTANCE OF RELIGION TO RESIDENTS AND TEEN BIRTH RATES BY STATE

Percent of adults who say religion is very important to them | Teen births (15-19) per 1,000 women



Source: CDC | Pew Research • [Get the data](#)

Landor et al (2010)

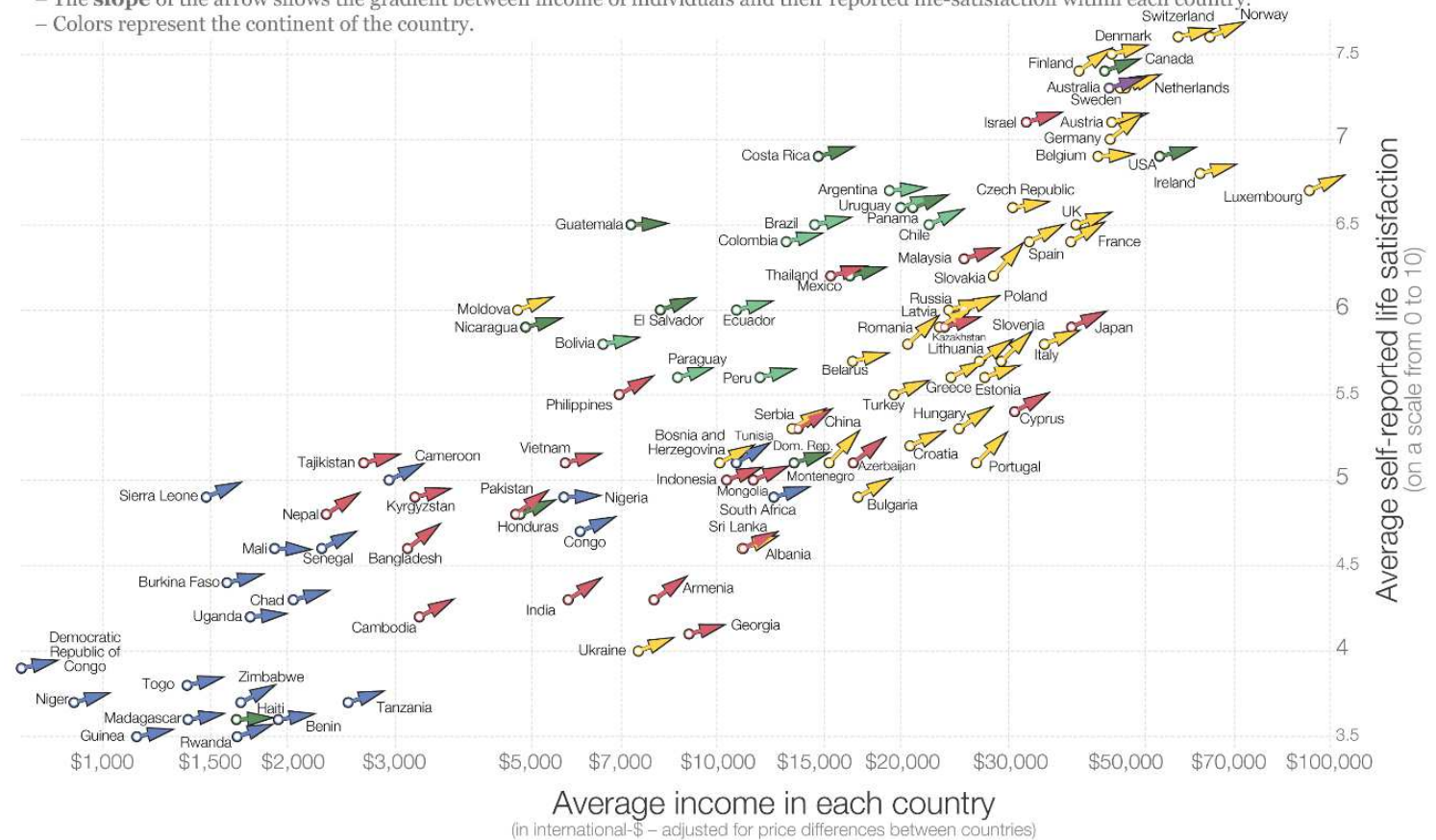


Chi-square = .327, d.f. = 2, $p = .85$
CFI = 1.000
RMSEA = .00
* $p < .05$

Ortiz-Ospina & Roser (2017)

People in richer countries tend to be happier and within all countries richer people tend to be happier

- The **position** of the arrow shows the average life satisfaction reported by the population of a country (vertical axis) and the average income of that country (horizontal axis).
- The **slope** of the arrow shows the gradient between income of individuals and their reported life-satisfaction within each country.*
- Colors represent the continent of the country.



* The gradients correspond, country by country, to the regression coefficients between income quintiles and the related average life satisfaction reported by people within each income quintile.
Data sources: *World Bank* for data on incomes by quintile (based on income shares by quintile and GDP per capita as the mean income); *Gallup World Poll* for life satisfaction by income quintile.
 The visualization is available at OurWorldinData.org. There you find the research and more visualizations on life satisfaction. Licensed under CC-BY-SA by the author Max Roser.

Helliwell et al. (2024)

Figure 2.6: Happiness changes from 2006-2010 to 2021-2023

Rectangular Snip

