Unit 8:
Large-N Applications of QCA

Example 1

Intersectional Inequalities

Intersectional Inequalities: A Fuzzy-Set Analysis of Family Background, Test Scores, and Poverty

- Inequality is a key feature of human social organization—some would say *the* key feature. In almost all known societies, inequalities coincide. Those at the top of social hierarchies do their best to fortify their advantages, while those at the bottom struggle to gain leverage.
- In modern societies, coinciding inequalities are reflected in the substantial correlations among individual-level aspects such as family background, education, and test scores. When studying life outcomes such as poverty, researchers typically estimate the net, independent contribution of these distinct yet correlated individual-level characteristics, treating each as an "independent" variable.

Intersecting Inequalities: A Fuzzy-Set Analysis of Family Background, Test Scores, and Poverty

- In the *Bell Curve* debate, for example, scholars contest the "correct" estimate of the effect of test scores (from the Armed Forces Qualification Test) on poverty, net of the effect of family background and other correlated variables. I offer an alternative to the examination of correlations and the estimation of net effects. This alternative approach is based on the analysis of set-theoretic relations. To illustrate my approach, I present a fuzzy-set analysis of the same National Longitudinal Survey of Youth data set used by adversaries in the *Bell Curve* debate.

I. The Bell Curve Debate

The debate started in the mid 1990s following the publication of ***The Bell Curve*** by Richard Herrnstein and Charles Murray.

H&M argue that "intelligence"

- is (a) unidimensional, (b) inborn, and (c) relatively easy to measure.
- is more important than parental SES in its impact on life chances (e.g., staying out of poverty).
- has increased in importance because high cognitive ability is the key to success in an advanced, technologically sophisticated economy—a trend that is sure to continue.

The debate that H&M spawned

- is primarily about effect sizes.
- focuses mostly on the net effect of test scores (Armed Forces Qualification Test) relative to the effects of other causal conditions (e.g., parental SES).

The estimate of the net effect of test scores, like virtually all such estimates, is specification dependent. Consider, for illustration, the following logistic regression analyses of ***The Bell Curve*** data (National Longitudinal Survey of Youth), with poverty as the outcome ("in poverty" = 1).

The Bell Curve versus ***Inequality By Design*** (White sample)

	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)	(A7)	(A8)	(A9)
Intercept	-2.8535**	-2.8815**	-2.7951**	-3.3355**	-1.0545	-1.5690	-.5260	.5255	2.2967
	(.0885)	(.0898)	(.2461)	(.3099)	(.9167)	(.9324)	(.9679)	(1.0577)	(.9546)
AFQT	**-.8434****	**-.7027****	**-.6839****	**-.6630****	**-.4511****	**-.4489****	**-.4494****	**-.4104****	
	(.0716)	**(.0806)**	**(.0823)**	**(.0842)**	**(.0979)**	**(.0979)**	**(.1003)**	**(.1078)**	
SES		-.2973							
		(.0802)							
Age		-.0478	-.0834	-.0210	-.0673	-.0644	-.0130	.0097	.0273
		(.0738)	(.0842)	(.0849)	(.1083)	(.1086)	(.1096)	(.1189)	(.1179)
Family Income			-.4441**	-.4416**	-.4328**	-.4199**	-.4194**	-.3781**	-.3957**
			(.1218)	(.1233)	(.1248)	(.1243)	(.1252)	(.1343)	(.1346)
Parents' SEI			-.0734	-.0736	-.0560	-.0444	-.0336	-.0475	-.0692
			(.0857)	(.0882)	(.0898)	(.0900)	(.0908)	(.1008)	(.0993)
Mother's Education			.0048	-.0345	.0048	.0058	.0297	.0651	.0342
			(.0895)	(.0908)	(.0932)	(.0935)	(.0941)	(.1019)	(.1013)
Father's Education			-.0334	-.0418	.0071	.0111	.0082	-.0134	-.0476
			(.0986)	(.1000)	(.1035)	(.1038)	(.1057)	(.1159)	(.1147)
Siblings (1979)			.1839**	.1685**	.1385*	.1429*	.1410*	.0399	.0351
			(.0650)	(.0675)	(.0687)	(.0691)	(.0699)	(.0768)	(.0765)
Farm Background			-.2593	-.2899	-.2868	-.3402	-.2153	-.2634	-.3220
			(.3120)	(.3185)	(.3184)	(.3219)	(.3229)	(.3604)	(.3563)
Two-Parent Family			-.2331	-.0919	-.1163	-.1073	-.0969	-.0544	-.0171
			(.2375)	(.2451)	(.2457)	(.2466)	(.2491)	(.2759)	(.2731)
Missing Fam. Income			.0235	.0720	.0799	.0416	-.0035	.0369	.0601
			(.2855)	(.2885)	(.2911)	(.2925)	(.2961)	(.3167)	(.3132)
Independent (Miss. Inc.)			.4364	.2048	.1107	.0952	-.0700	-.2059	-.2872
			(.3395)	(.3422)	(.3431)	(.3442)	(.3481)	(.3800)	(.3757)
Missing Parents' SEI			-.1740	-.1745	-.1546	-.1722	-.1909	-.0750	.0510
			(.3236)	(.3314)	(.3335)	(.3336)	(.3375)	(.3714)	(.3681)
Missing Mother's Ed.			-.0806	.0048	-.0741	-.0606	-.0149	.0780	.1868
			(.3556)	(.3571)	(.3570)	(.3581)	(.3622)	(.4106)	(.4027)
Missing Father's Ed.			.3615	.4141	.3616	.3906	.3576	.2448	.2415
			(.2659)	(.2675)	(.2671)	(.2692)	(.2722)	(.3079)	(.3047)
Fewer Dropout Students				-.1963**	-.1919**	-.2016**	-.2000**	-.2161**	-.2251**
				(.0729)	(.0743)	(.0740)	(.0754)	(.0831)	(.0824)

The Bell Curve versus ***Inequality By Design*** (White sample)

Fewer Disad. Students				-.0284	-.0207	.0232	.0079	-.0431	-.0695
				(.1257)	(.1262)	(.1269)	(.1280)	(.1375)	(.1363)
Fewer Nonwhite Students				-.3119*	-.3310*	-.3490*	-.3420*	-.3221*	-.3547*
				(.1384)	(.1395)	(.1434)	(.1441)	(.1552)	(.1554)
Missing Dropout Stud.				-.0428	.0651	.0239	-.0358	-.0963	.0363
				(.3927)	(.3907)	(.3922)	(.3941)	(.4489)	(.4316)
Missing Disad. Stud.				.1588	.1758	.2093	.2033	.1576	.1133
				(.2368)	(.2376)	(.2396)	(.2421)	(.2619)	(.2592)
Missing Nonwhite Stud.				.3189	.2138	.2274	.2183	.0902	-.0196
				(.3939)	(.3941)	(.3941)	(.3940)	(.4415)	(.4286)
West Region				.8926**	.8566**	.7905**	.8274**	.5445*	.5416*
				(.2258)	(.2291)	(.2380)	(.2401)	(.2608)	(.2593)
Northeast Region				.0397	.0947	.1081	.1266	-.0345	-.0521
				(.2760)	(.2785)	(.2860)	(.2881)	(.3104)	(.3078)
Central Region				.5798**	.5782**	.4813*	.5057*	.2806	.2907
				(.2033)	(.2054)	(.2161)	(.2183)	(.2353)	(.2349)
Years of Ed. pre-AFQT					-.1575*	-.1575*	-.2182**	-.2489**	-.3817**
					(.0736)	(.0737)	(.0761)	(.0829)	(.0760)
H.S. Academic Track					-.4899	-.4795	-.4695	-.2176	-.3502
					(.2568)	(.2578)	(.2584)	(.2737)	(.2683)
Years of Ed. post-AFQT					-.2235**	-.2326**	-.2295**	-.1910**	-.2550**
					(.0676)	(.0684)	(.0684)	(.0711)	(.0689)
Unemployment Rate (1990)						.0833*	.0809	.0701	.0710
						(.0423)	(.0426)	(.0472)	(.0467)
Central City (1990)						.5186	.5749*	.4892	.4270
						(.2696)	(.2714)	(.2868)	(.2853)
Rural (1990)						.1534	.1706	.1410	.1406
						(.1970)	(.1988)	(.2183)	(.2159)
Male							-.8219**	-.9718**	-.9973**
							(.1649)	(.2254)	(.2226)
Children (1990)								.7213**	.7141**
								(.0887)	(.0875)
Married (1990)								-3.0629**	-3.1042**
								(.2569)	(.2570)
Married Man (1990)								1.0432**	1.1044**
								(.3605)	(.3576)
Pseudo R^2	0.0948	0.1037	0.1209	0.1475	0.1623	0.1682	0.1849	0.3238	0.3145

The Bell Curve versus ***Inequality By Design*** (African-American sample)

	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)	(B7)	(B8)	(B9)
Intercept	-1.1171**	-1.1513**	-1.2421**	-1.8618**	2.2521**	1.4504*	2.6730**	2.0534**	3.0998**
	(.0601)	(.0617)	(.1380)	(.1788)	(.6820)	(.7194)	(.7604)	(.8249)	(.7762)
AFQT	**-.8031****	**-.6869****	**-.6858****	**-.6705****	**-.3730****	**-.3694****	**-.3904****	**-.3638****	
	(.0674)	**(.0707)**	**(.0725)**	**(.0746)**	**(.0850)**	**(.0856)**	**(.0885)**	**(.0945)**	
SES		-.2973	-.3488**						
		(.0802)	(.0630)						
Age		-.0478	-.0462	-.0364	-.0110	.0003	.0187	-.0088	-.0094
		(.0738)	(.0582)	(.0658)	(.0821)	(.0822)	(.0844)	(.0900)	(.0894)
Family Income			-.4441**	-.3435**	-.3308**	-.3151**	-.2717**	-.2499*	-.2629*
			(.1218)	(.0994)	(.1009)	(.1019)	(.1004)	(.1050)	(.1062)
Parents' SEI			-.0734	-.2221**	-.2307**	-.2329**	-.2603**	-.2007*	-.2269**
			(.0857)	(.0780)	(.0805)	(.0810)	(.0828)	(.0873)	(.0868)
Mother's Education			.0048	-.1613*	-.0851	-.0851	-.0437	-.0173	-.0368
			(.0895)	(.0744)	(.0765)	(.0770)	(.0794)	(.0857)	(.0847)
Father's Education			-.0334	.0369	.0811	.0882	.0924	.0917	.0839
			(.0986)	(.0853)	(.0879)	(.0884)	(.0901)	(.0971)	(.0963)
Siblings (1979)			.1839**	-.0354	-.0615	-.0662	-.0732	-.0464	-.0228
			(.0650)	(.0645)	(.0661)	(.0665)	(.0684)	(.0729)	(.0719)
Farm Background			-.2593	-.0053	-.1176	-.2187	-.1888	-.2558	-.2127
			(.3120)	(.3592)	(.3658)	(.3701)	(.3857)	(.4323)	(.4262)
Two-Parent Family			-.2331	-.0843	-.0558	-.0431	-.0376	-.0143	.0022
			(.2375)	(.1477)	(.1503)	(.1516)	(.1546)	(.1643)	(.1633)
Missing Fam. Income			.0235	-.2040	-.2023	-.2531	-.2189	-.2863	-.2079
			(.2855)	(.2309)	(.2351)	(.2376)	(.2419)	(.2599)	(.2600)
Independent (Miss. Inc.)			.4364	.7011*	.6119	.6490*	.4181	.3977	.2968
			(.3395)	(.3053)	(.3137)	(.3166)	(.3254)	(.3493)	(.3457)
Missing Parents' SEI			-.1740	.1473	.1471	.1138	.3254	.1115	.1477
			(.3236)	(.1710)	(.1758)	(.1770)	(.1807)	(.1917)	(.1911)
Missing Mother's Ed.			-.0806	.0921	-.0609	-.0429	-.0123	.0490	.0817
			(.3556)	(.2167)	(.2219)	(.2229)	(.2305)	(.2434)	(.2434)
Missing Father's Ed.			.3615	.1862	.1503	.1730	.1843	.1115	.1275
			(.2659)	(.1448)	(.1472)	(.1483)	(.1530)	(.1623)	(.1610)
Fewer Dropout Students				-.1257	-.0602	-.0761	-.0571	-.0575	-.0567
				(.0766)	(.0799)	(.0814)	(.0820)	(.0863)	(.0862)

The Bell Curve versus ***Inequality By Design*** (African-American sample)

Fewer Disad. Students			-.1519	-.1543	-.1513	-.1648	-.1482	-.1620
			(.0808)	(.0826)	(.0837)	(.0858)	(.0913)	(.0913)
Fewer Nonwhite Students			-.1096	-.1405	-.1629	-.1373	-.1832	-.1999
			(.0940)	(.0956)	(.0997)	(.1012)	(.1075)	(.1070)
Missing Dropout Stud.			-.0028	-.1006	-.0724	-.1855	-.3428	-.3495
			(.3236)	(.3272)	(.3311)	(.3408)	(.3604)	(.3577)
Missing Disad. Stud.			.1306	.1658	.1914	.1221	.1929	.2221
			(.2117)	(.2155)	(.1914)	(.2252)	(.2420)	(.2415)
Missing Nonwhite Stud.			.4012	.4267	.4366	.5533	.6538	.7071
			(.3523)	(.3560)	(.3613)	(.3693)	(.3860)	(.3825)
West Region			.6579*	.7042**	.6559*	.6821*	.6189*	.6616*
			(.2626)	(.2658)	(.2737)	(.2816)	(.2935)	(.2920)
Northeast Region			.4669*	.3560	.2505	.3367	.2105	.1208
			(.1884)	(.1944)	(.2043)	(.2065)	(.2152)	(.2137)
Central Region			.8355**	.8132**	.7523**	.7980**	.5757**	.5206**
			(.1577)	(.1599)	(.1645)	(.1689)	(.1816)	(.1792)
Years of Ed. pre-AFQT				-.3260**	-.3183**	-.3861**	-.3490**	-.4351**
				(.0571)	(.0575)	(.0602)	(.0641)	(.0600)
H.S. Academic Track				-.4329**	-.4361**	-.4025*	-.3631*	-.4513**
				(.1646)	(.1655)	(.1679)	(.1776)	(.1749)
Years of Ed. post-AFQT				-.2459**	-.2399**	-.2565**	-.2092**	-.2617**
				(.0557)	(.0560)	(.0573)	(.0609)	(.0588)
Unemployment Rate (1990)					.1200**	.1177	.1282**	.1273**
					(.0406)	(.0414)	(.0444)	(.0441)
Central City (1990)					.1553	.1689	.0372	.0613
					(.1559)	(.1598)	(.1698)	(.1684)
Rural (1990)					.2053	.2118	.2774	.2974
					(.1706)	(.1745)	(.1870)	(.1861)
Male						-.9977**	-.6644**	-.6653**
						(.1338)	(.1712)	(.1701)
Children (1990)							.4252**	.4200**
							(.0609)	(.0607)
Married (1990)							-2.0396**	-2.0829**
							(.2272)	(.2264)
Married Man (1990)							.1896	.2241
							(.3629)	(.3621)
Pseudo R^2	0.0859	0.1021	0.1175	0.1469	0.1771	0.1833	0.2129	0.2917	0.2841

Notes:

- AFQT scores have been massaged (by H&M) so that they are normally distributed (the raw test scores are not) and then converted to z scores.
- Parental SES is also converted to z scores, to permit direct comparison of its effect with that of AFQT.
- H&M avoid using AFQT test percentile scores because they are very interested in foregrounding the effect of being in the "cognitive elite." That is, they want to make sure that their analysis assesses the impact of being in the 99^{th} percentile versus the 99.9^{th} percentile versus the 99.99^{th} percentile.

Observations:

- The effect of test scores declines as the number of competing variables is increased (from 2 to more than 20).
- The standard error of the test score variable increases as the number of competing variables increases.
- The impact of disaggregating SES into its components is nontrivial (this is one of Fischer et al.'s main points).
- In Fischer et al.'s (final) analysis the independent contribution of test scores is very small (compare the pseudo R^2 values in the last two columns).
- Overall, the pseudo R^2 values increase from small (around 10% in H&M's analysis) to moderate (around 30% in Fischer et al.'s analysis).
- The results for Whites and African-Americans are very similar.

A Middle Path

	White Males		White Females		Black Males		Black Females	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	1.527	2.927***	1.953*	2.945***	3.748***	4.291***	5.533***	6.477***
	(.971)	(.864)	(.993)	(.921)	(.863)	(.820)	(.926)	(.878)
AFQT (percentile)	-.021***		-.018**		-.016*		-.021**	
	(.006)		(.006)		(.008)		(.007)	
Parental Income	-.151**	-.166***	-.051	-.063	-.121*	-.140*	-.121**	-.142**
	(.051)	(.051)	(.038)	(.038)	(.059)	(.058)	(.046)	(.046)
Parental Education	-.036	.010	-.019	-.003	-.028	-.044	-.034	-.022
	(.056)	(.055)	(.052)	(.051)	(.044)	(.043)	(.040)	(.040)
Respondent Education	-.212*	-.362***	-.256**	-.373***	-.340***	-.389***	-.480***	-.572***
	(.085)	(.073)	(.084)	(.074)	(.068)	(.064)	(.076)	(.070)
Married	-1.544***	-1.567***	-2.855***	-2.885***	-1.767***	-1.813***	-2.093***	-2.125***
	(.341)	(.332)	(.271)	(.269)	(.338)	(.337)	(.244)	(.244)
Children	.738*	.699*	1.745***	1.777***	.569*	.592*	.769***	.753***
	(.343)	(.332)	(.273)	(.271)	(.271)	(.270)	(.225)	(.223)
N	1363	1363	1315	1315	732	732	775	775
Pseudo R^2	0.182	0.164	0.329	0.317	0.173	0.167	0.286	0.277

Notes:

The analysis is by race and gender, not just by race. This approach reveals the stronger impact of marriage (positive) and children (negative) on poverty status for females.

This difference aside, the results are remarkably similar for the four subsamples.

The effect of AFQT scores, when viewed from the perspective of the pseudo R^2 increment, is (again) very modest.

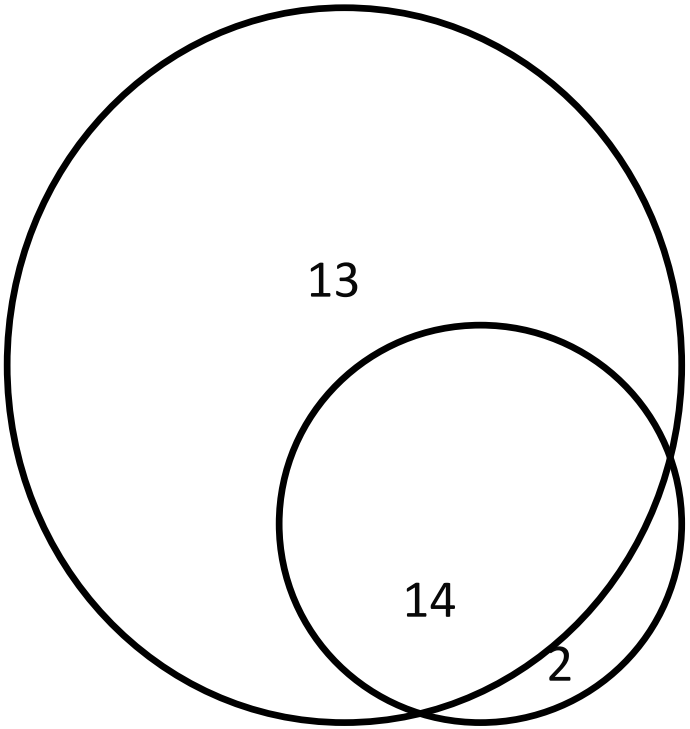
Pseudo R^2 values are somewhat higher for females than for males.

Set Coincidence

- Set coincidence combines and bridges consistency and coverage. Set coincidence focuses on the degree to which two sets overlap—that is, the degree to which they are one and the same set.
- While degree of set coincidence can be assessed using multiple sets (i.e., more than two), it is easiest to grasp the basic principles using two sets. For example, the degree to which the set of *surviving* 3rd wave democracies and the set of 3rd wave democracies *with parliamentary governments* are "one and the same" is indicated by the degree to which the cases than have *both* of these two traits embraces the set of cases that have *either* trait. In other words, set coincidence is the number of cases found in the intersection of two sets, expressed relative to the number of cases found in their union:

  (# of cases in intersection)/(# of cases in union)

In the next figure, the coincidence of "Parliamentary" and "Democracy Survived" is 14/29 = 0.483 (i.e., relatively modest).

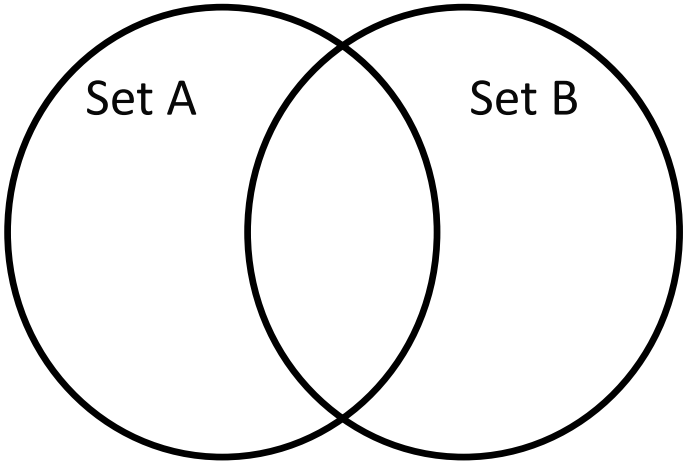


Set of surviving 3rd wave democracies

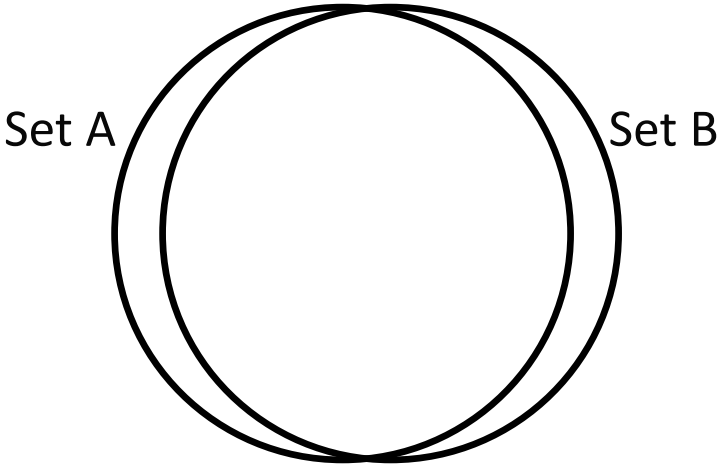
Set of 3rd wave democracies with parliamentary governments

Coincidence of sets = 14/(13+ 14+ 2) = 14/29 = 0.483

Here are two graphic examples, showing the contrast between high and low coincidence:



Low set coincidence: set intersection is a small fraction of set union.

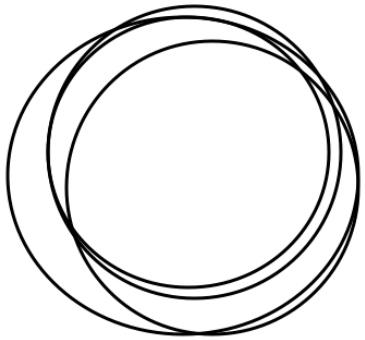


High set coincidence: set intersection almost fully “covers” set union.

Set Coincidence and the Study of Social Inequality

A. Multiple Set Coincidence

Sometimes the intersection of several sets can occupy a large proportion of the union of these same sets. This would occur, for example, in a situation where social advantages (or disadvantages) strongly overlap. The formula for the calculation of the coincidence of multiple sets is the same as it is for two sets: *(sum of membership in the intersection)/(sum of membership in the union).*



As the number of sets increases, the possibility of strong overlap decreases, unless the pattern of set coincidence is very strong.

Implications of Multiple Set Coincidence for the Study of Social Inequality

- A basic sociological principle is that people try to compound their advantages and try to avoid having multiple disadvantages.

- This notion of "compounding" is directly captured by the concept of multiple set coincidence. If advantages or disadvantages tend to cohere (i.e., to be multiple), compounding will be reflected in the relative number of people who combine multiple traits. In other words, if compounding is present, the *intersection* of the relevant sets will "cover" much of the *union* of these same sets.

- The analysis of set coincidence, therefore, is central to the analysis of social inequality.

The Asymmetry of Set Coincidence

At first glance, it may appear that set coincidence is roughly the same as correlation. It is not. Set coincidence is asymmetric and thus sensitive to the specification of the sets in question. Consider the following table:

	Supports Reform	Opposes Reform
Republican	50	250
Democrat	100	50

Focusing on the coincidence of “Republican” with “Opposes Reform,” the calculation is intersection/union (# of cases in both sets / # of cases in either set):

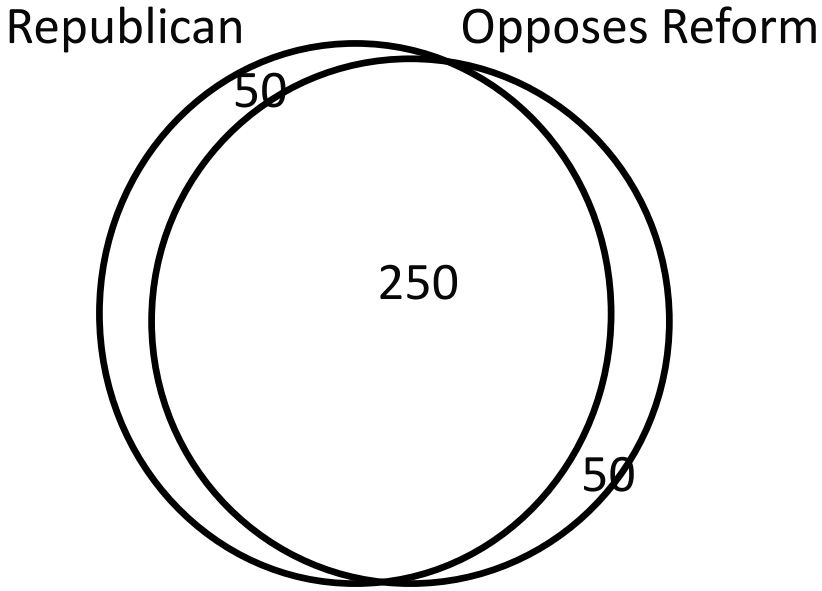
$$250 / (250 + 50 + 50) = 250 / 350 = 0.71$$

However, shifting the focus to the coincidence of “Democrat” with “Supports Reform” yields a different calculation:

$$100 / (100 + 50 + 50) = 100 / 200 = 0.50$$

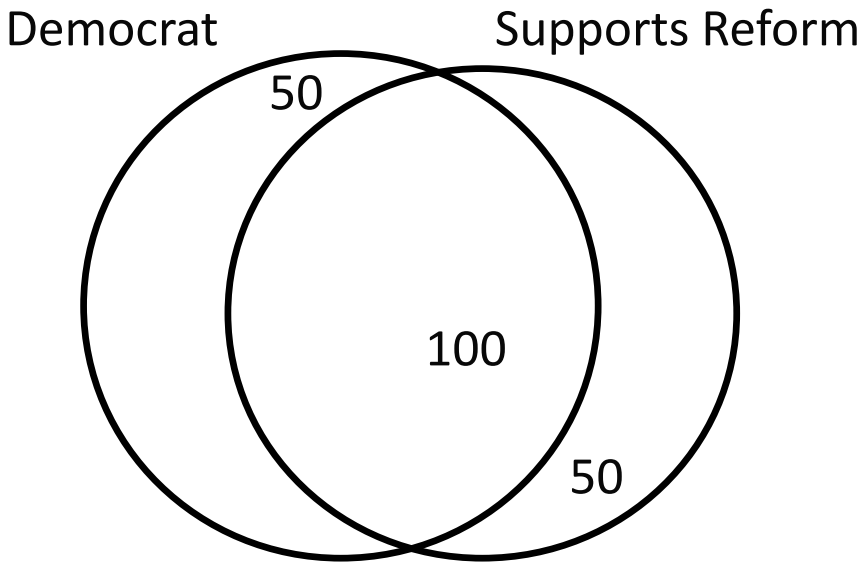
Here are the contrasting emphases as Venn diagrams:

Coincidence of “Republican” and “Opposes Reform”



Set coincidence = 250/(250 + 50 + 50) = 0.71

Coincidence of “Democrat and Supports Reform”



Set coincidence = 100/(100+ 50 + 50) = 0.50

Implications of the Asymmetry of Set Coincidence for the Study of Social Inequality

- Because set coincidence is asymmetric, the assessment of the degree to which advantages are combined is distinct from the assessment of the degree to which disadvantages are combined.

- This feature distinguishes set coincidence from correlational measures and provides the opportunity to differentiate the compounding of advantages from the compounding of disadvantages. In the language of set theory, the issue is which is stronger, the coincidence of sets A and B or the coincidence sets of ~A and ~B?

Implications of the Asymmetry of Set Coincidence for the Study of Social Inequality

- *If advantages coincide strongly and disadvantages do not* (or at least not as strongly), the implication is that people strive to fortify their position by seeking to combine and reinforce their advantages.
- *If disadvantages coincide strongly and advantages do not* (or at least not as strongly), the implication is that people may succumb to downward social forces and be subject to an accumulation of disadvantages.
- The relative importance of coinciding advantages versus coinciding disadvantages may differ by race and gender.

C. The Divergence of Set Coincidence and Correlation

It is possible for two sets to display **strong coincidence**, yet as variables exhibit only a **weak correlation**.

For example, a researcher might want to assess the degree to which respondents combine moderate-to-high parental income with moderate-to-high AFQT test scores. In the following table, most respondents (500) combine the two advantages. A moderate number of respondents (200) have one advantage but not both, and a small number have neither advantage (50).

Parental Income	**low AFQT scores**	**medium-high AFQT scores**	*Total*
medium-high	100	500	600
low	50	100	150
Total	150	600	750

Set coincidence of medium-high parental income with medium-high test scores:

500/700 = **0.714** (i.e., a high level of confounding)

Correlation = **0.167** (i.e., a low level of confounding)

Implications

- *From the perspective of correlational/net effects analysis, a weak correlation provides an opportunity to estimate net effects without much concern for confounding. However, strong set coincidence may coexist with weak correlations.*

- *From a set theoretic point of view, strong set coincidence raises questions about the utility of analyses that seek to disentangle the effects of overlapping characteristics.*

V. Concept of Set Coincidence Applied to *Bell Curve* Data

The outcome is

not-in poverty, *a fuzzy set based on the ratio of the respondent's household income to the poverty level for households of that type.*

The four main causal conditions (advantages/disadvantages) are

1. ***parent educated****, a fuzzy set based on the years of education (for the parent with more years of education);*
2. ***not-low income parents****, a fuzzy set based on the ratio of parental household income to the poverty level for households of that type;*
3. ***not-low AFQT score****, a fuzzy set based on AFQT percentile scores;*
4. ***respondent educated****, a fuzzy set based on respondent's years of education.*

Question #1: Which are stronger, coinciding advantages or coinciding disadvantages?

Sets	black females	black males	white female	white males
nlpinc nlafqt	0.491	0.482	0.861	0.844
lpinc lafqt	*0.460*	*0.405*	*0.131*	*0.150*
nlafqt edu	0.538	0.523	0.745	0.727
lafqt neduc	*0.450*	*0.460*	*0.259*	*0.286*
nlpinc peduc	0.514	0.522	0.662	0.669
lpinc npeduc	*0.479*	*0.426*	*0.108*	*0.119*

Advantages
nlpinc = not-low parental income
nlafqt = not-low test scores (AFQT)
educ = educated respondent
peduc = educated parent

Disadvantages
lpinc = low parental income
lafqt = low test scores (AFQT)
neduc = not educated respondent
npeduc = not educated parent

In general, advantages coincide more than disadvantages. Also, there is a very striking racial difference—whites enjoy much stronger coinciding advantages and have a very low level of coinciding disadvantages.

Question #2: How strongly do *multiple* advantages coincide?

Black females

	Coincidence
nlpinc*nlafqt	0.491
educ*nlpinc*nlafqt	0.371
educ*peduc*nlpinc*nlafqt	0.283

Black males

	Coincidence
nlpinc*nlafqt	0.482
educ*nlpinc*nlafqt	0.358
educ*peduc*nlpinc*nlafqt	0.284

White females

	Coincidence
nlpinc*nlafqt	0.861
nlpinc*nlafqt*educ	0.676
educ*peduc*nlpinc*nlafqt	0.573

White males

	Coincidence
nlpinc*nlafqt	0.844
educ*nlpinc*nlafqt	0.654
educ*peduc*nlpinc*nlafqt	0.559

Question #3: Do correlations and coincidence scores agree?

White males: coincidence scores

	peduc	nlpinc	nlafqt
nlpinc	0.669	--	--
nlafqt	0.672	0.844	--
educ	0.767	0.710	0.727

Average coincidence score = 0.731

White males: correlations

	peduc	nlpinc	nlafqt
nlpinc	0.231	--	--
nlafqt	0.373	0.256	--
educ	0.477	0.227	0.518

Average correlation = 0.347

nlpinc = not-low parental income
educ = educated respondent

nlafqt = not-low test scores (AFQT)
peduc = educated parent

White females: coincidence scores

	peduc	nlpinc	nlafqt
nlpinc	0.662	--	--
nlafqt	0.669	0.861	--
educ	0.775	0.716	0.745

Average coincidence score = 0.738

White females: correlations

	peduc	nlpinc	nlafqt
nlpinc	0.219	--	--
nlafqt	0.339	0.229	--
educ	0.501	0.181	0.477

Average correlation = 0.324

nlpinc = not-low parental income
educ = educated respondent

nlafqt = not-low test scores (AFQT)
peduc = educated parent

Black males: coincidence scores

	peduc	nlpinc	nlafqt
nlpinc	0.522	--	--
nlafqt	0.457	0.482	--
educ	0.623	0.559	0.523

Average coincidence score = 0.528

Black males: correlations

	peduc	nlpinc	nlafqt
nlpinc	0.351	--	--
nlafqt	0.330	0.279	--
educ	0.283	0.192	0.489

Average correlation = 0.321

nlpinc = not-low parental income
educ = educated respondent

nlafqt = not-low test scores (AFQT)
peduc = educated parent

Black females: coincidence scores

	peduc	nlpinc	nlafqt
nlpinc	0.514	--	--
nlafqt	0.451	0.491	--
educ	0.620	0.573	0.538

Average coincidence score = 0.531

Black females: correlations

	peduc	nlpinc	nlafqt
nlpinc	0.388	--	--
nlafqt	0.321	0.335	--
educ	0.387	0.336	0.533

Average correlation = 0.383

nlpinc = not-low parental income
educ = educated respondent

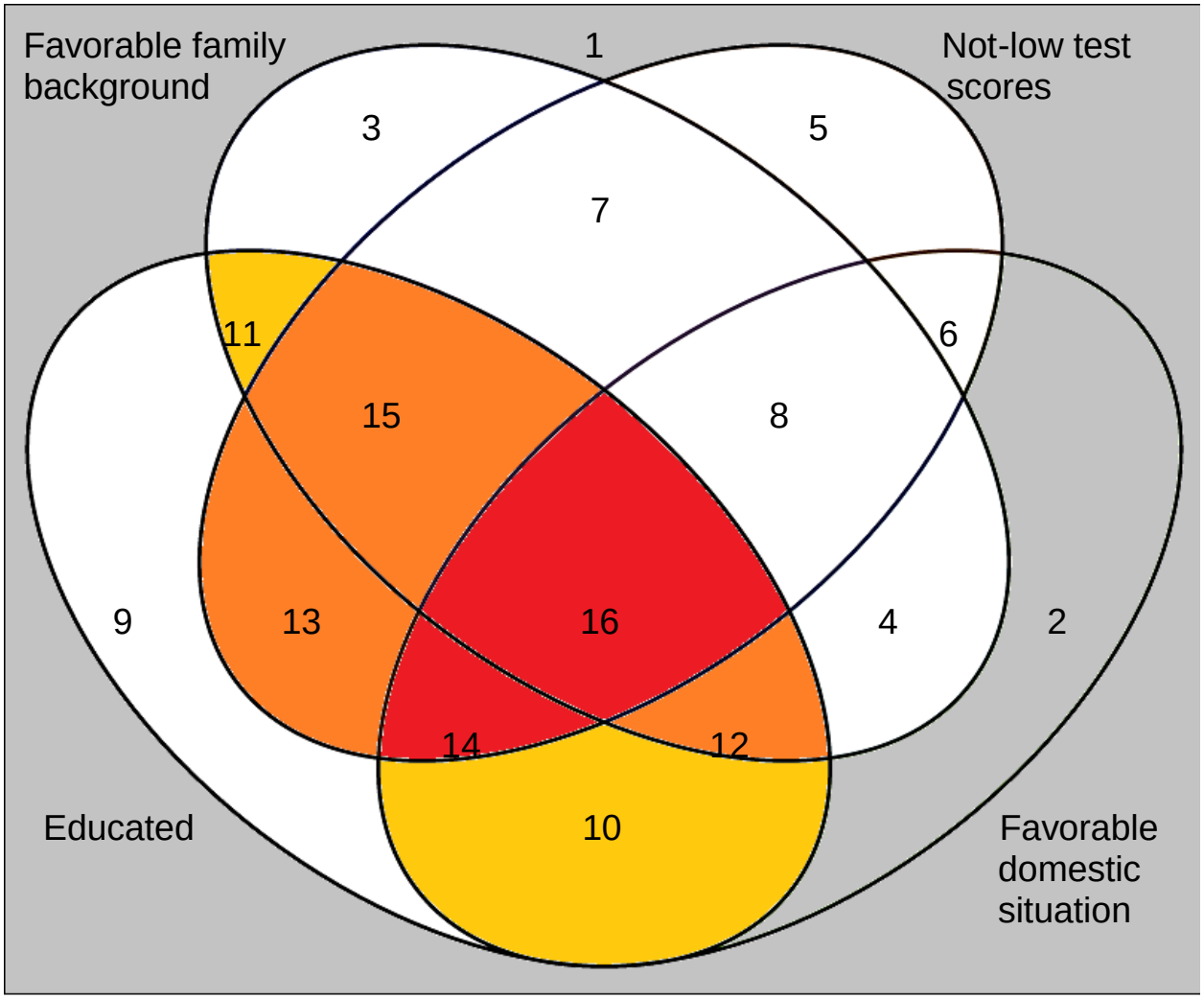
nlafqt = not-low test scores (AFQT)
peduc = educated parent

VI. Fuzzy Set Analysis of Poverty Status

Truth table for white males showing the three outcomes

Row #	Educated	Not-low test scores	Favorable family background	Favorable domestic situation	Number of conforming cases	Cons. ≥ 0.90	Cons. ≥ 0.85	Cons. ≥ .80
1	no	no	no	no	25	0	0	0
2	no	no	No	yes	43	0	0	0
3*	no	no	Yes	no	11	-	-	-
4*	no	no	Yes	yes	6	-	-	-
5*	no	yes	No	no	6	-	-	-
6*	no	yes	No	yes	11	-	-	-
7*	no	yes	Yes	no	16	-	-	-
8*	no	yes	Yes	yes	17	-	-	-
9*	yes	no	No	no	14	-	-	-
10	yes	no	No	yes	28	0	0	1
11	yes	no	Yes	no	31	0	0	1
12	yes	no	Yes	yes	34	0	1	1
13	yes	yes	No	no	72	0	1	1
14	yes	yes	No	yes	114	1	1	1
15	yes	yes	Yes	no	377	0	1	1
16	yes	yes	Yes	yes	550	1	1	1

*Indicates rows that fail to meet the frequency threshold of 1.5% of cases.



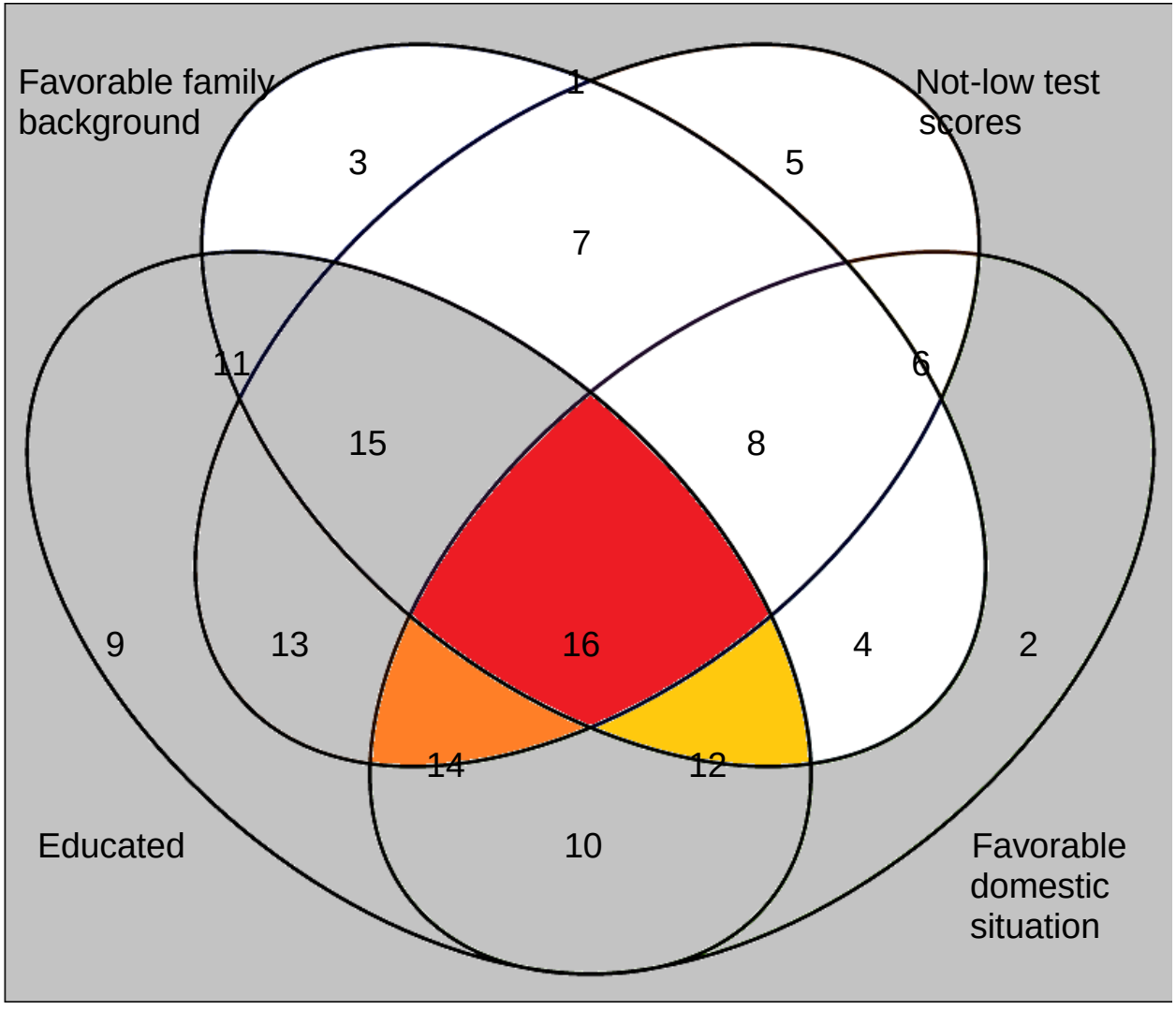
Subset consistency ≥ 0.90
Subset consistency 0.85 → 0.89
Subset consistency 0.80 → 0.84
Subset consistency < 0.80
[ ] Below frequency threshold of 1.5% of cases

Consistency threshold	Causal recipe	Subset consistency	Outcome coverage
0.90	educated•not-low-test-scores•favorable-domestic-situation	0.915	0.552
0.85	educated•not-low-test-scores + educated•favorable-family-background•favorable-domestic-situation	0.886 0.921	0.732 0.498
0.80	educated•not-low-test-scores + educated•favorable-family-background + educated•favorable-domestic-situation	0.886 0.900 0.906	0.732 0.621 0.588

Truth table for black females showing the three outcomes

Row #	Educated	Not-low test scores	Favorable family background	Favorable domestic situation	Number of conforming cases	Cons. ≥ 0.90	Cons. ≥ 0.85	Cons. ≥ .80
1	no	no	no	no	76	0	0	0
2	no	no	no	yes	22	0	0	0
3*	no	no	yes	no	6	-	-	-
4*	no	no	yes	yes	0	-	-	-
5	no	yes	no	no	5	-	-	-
6*	no	yes	no	yes	2	-	-	-
7*	no	yes	yes	no	1	-	-	-
8*	no	yes	yes	yes	0	-	-	-
9	yes	no	no	no	180	0	-0	0
10	yes	no	no	yes	87	0	0	0
11	yes	no	yes	no	39	0	0	0
12	yes	no	yes	yes	16	0	0	1
13	yes	yes	no	no	108	0	0	0
14	yes	yes	no	yes	74	0	1	1
15	yes	yes	yes	no	88	0	0	0
16	yes	yes	yes	yes	62	1	1	1

*Indicates rows that fail to meet the frequency threshold of 1.5% of cases.



Subset consistency ≥ 0.90
Subset consistency 0.85 → 0.89
Subset consistency 0.80 → 0.84
Subset consistency < 0.80

Consistency threshold	Causal recipe	Subset consistency	Outcome coverage
0.90	educated•not-low-test-scores•favorable-family-background•favorable-domestic-situation	0.923	0.210
0.85	educated•not-low-test-scores•favorable-domestic-situation	0.881	0.366
0.80	educated•not-low-test-scores•favorable-domestic-situation + educated•favorable-family-background•favorable-domestic-situation	0.881 0.892	0.366 0.253

VII. Conclusions

Herrnstein and Murray argue, based on their research, that if a person could chose between being born into a high SES family or being born with a high level of “intelligence,” it would be better to choose “intelligence.” They base this statement on the stronger net effect of AFQT scores, compared to parental SES, on life outcomes such as poverty.

The set coincidence analysis shows clearly, for whites especially, that choosing either high SES or “intelligence” usually involves choosing the other. The set coincidence scores are very high, so much so that the whole idea of calculating the “net effect” of either seems hazardous, from a set theoretic perspective.

VII. Conclusions

More generally, the striking racial differences in coinciding advantages is invisible to correlational /net effects analysis. Both the logistic regression results and the correlational analysis show similarities across racial groups. This homogeneity contradicts both everyday experience and set theoretic analysis.

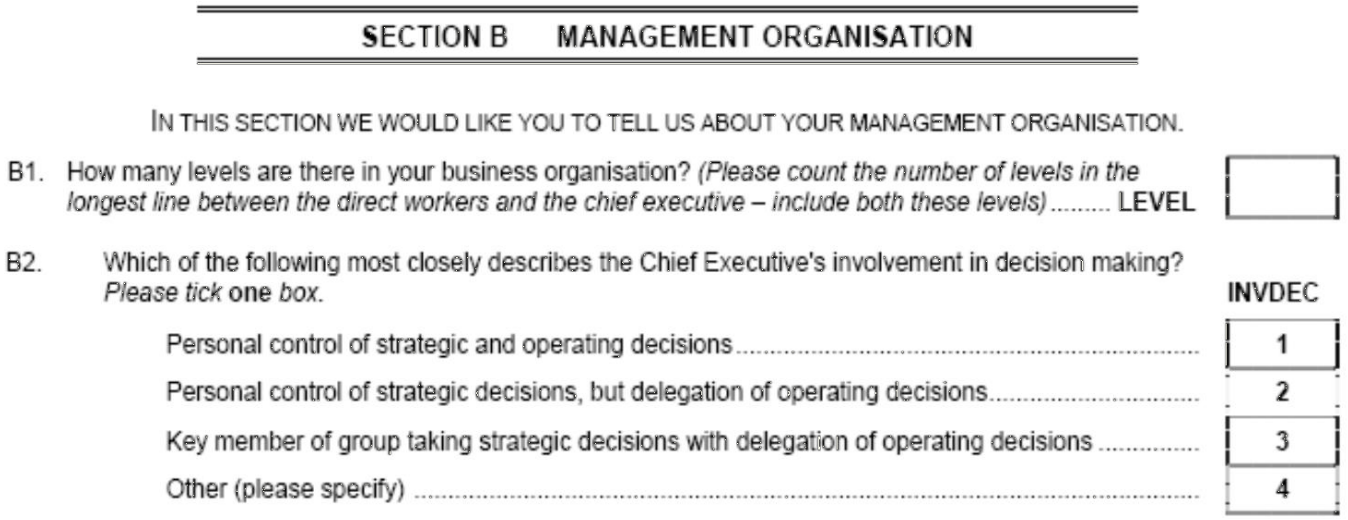
For whites, advantages cohere and appear to reinforce; disadvantages do not. For blacks, there is evidence of both reinforcing advantages and reinforcing disadvantages. However, the prevalence of reinforcing advantages is much lower for blacks than for whites.

Example 2

Configurations and Organizational Performance

Fiss (2011): Configurations and Organizational Performance

- Sample of 205 high-technology manufacturing firms in the UK (Cosh et al., 2002)
- Data collected in 1999 include items on organizational structure, strategy, and environment
- Complete data on performance available for 139 firms; missing values on independent measures imputed using MLE



SECTION B MANAGEMENT ORGANISATION

IN THIS SECTION WE WOULD LIKE YOU TO TELL US ABOUT YOUR MANAGEMENT ORGANISATION.

B1. How many levels are there in your business organisation? *(Please count the number of levels in the longest line between the direct workers and the chief executive – include both these levels)* ..... LEVEL

B2. Which of the following most closely describes the Chief Executive's involvement in decision making? *Please tick* **one** *box.*

INVDEC

Personal control of strategic and operating decisions	1
Personal control of strategic decisions, but delegation of operating decisions	2
Key member of group taking strategic decisions with delegation of operating decisions	3
Other (please specify)	4

Outcome of Interest

- **Performance** is measured based on Return on Assets (ROA) benchmarked to performance of the high technology sector (median ROA = 7.2%)
- Fuzzy set of *high performing* firms

  ROA ≥ 16.3% (75th percentile) → FS = 1.0

  ROA = 11.0% → FS = 0.5

  ROA ≤ 7.2% (50th percentile) → FS = 0.0

- Fuzzy set of *very high performing* firms

  ROA ≥ 25.0% → FS = 1.0

  ROA = 16.3% (75th percentile) → FS = 0.5

  ROA ≤ 7.2% (50th percentile) → FS = 0.0

Organizational Structure

- **Formalization** is measured using a set of 9 survey items that assess to what extent e.g.
  - Formal policies and procedures guide decisions
  - Communications are documented by memos
  - Reporting relationships are formally defined
  - Plans are formal and written
- Items combined into a scale (Cronbach's α = .83)
- Fuzzy set of firms with high degree of *formalization*

"Nearly always"	$\rightarrow$	FS = 1.0
"About half the time"	$\rightarrow$	FS = 0.5
"Almost never"	$\rightarrow$	FS = 0.0

Organizational Structure

- **Centralization** is measured using a set of 5 survey items that assess who is the last person whose permission must be obtained ("department head, division head, CEO, Board of Directors") for e.g.
  - Addition of a new product or service
  - Unbudgeted expenses
  - Selection of type or brand of new equipment
- Items combined into a scale (α = .74)
- Fuzzy set of firms with high degree of *centralization*

  "Board of Directors" $\rightarrow$ FS = 1.0

  scale mid-point $\rightarrow$ FS = 0.5

  "Department Head" $\rightarrow$ FS = 0.0

Organizational Structure

- **Complexity** is measured using a combined measure of vertical and horizontal differentiation
  - Vertical differentiation was measured as the number of levels in the longest line between direct worker and CEO (Pugh et al., 1968)
  - Horizontal differentiation was measured using the number of functions with at least one full-time employee (Pugh et al., 1968)
  - Complexity is calculated as the product of horizontal and vertical differentiation (Singh, 1986; Wong & Birnbaum More, 1994)
- Fuzzy set of firms with high degree of *complexity*

  99^{th} percentile (6 Levels / 17 Functions) $\rightarrow$ FS = 1.0

  50^{th} percentile (3 Levels / 9 Functions) $\rightarrow$ FS = 0.5

  1^{st} percentile (1 Level / 1 Function) $\rightarrow$ FS = 0.0

Organizational Structure

- **Size** is measured as average number of full time employees, with fuzzy set membership tied to US SME categories
- Fuzzy set of *large* firms

250+ employees	$\rightarrow$	FS = 1.0
50 employees	$\rightarrow$	FS = 0.5
10 or less employees	$\rightarrow$	FS = 0.0

Strategy

- **Differentiation strategy** measured as competitive capability based on product features and new product introduction, combined into 5-point scale (α = .80)
- **Low cost strategy** measured as competitive capability based on low labor cost, material cost, energy consumption, inventory cost, combined into 5-point scale (α = .86)
- Recoded into two fuzzy sets of firms with a *differentiation strategy* and *low cost strategy*

(5) "Critically important" $\rightarrow$ FS = 1.0
(3) *scale mid-point* $\rightarrow$ FS = 0.5
(1) "Not important" $\rightarrow$ FS = 0.0

Environment

- **Rate of Change** assesses how fast the environment is changing and is measured as length of main product life cycle in months, recoded into fuzzy set of firms operating in a *high velocity environment*

1 months	$\rightarrow$ FS = 1.0
36 months	$\rightarrow$ FS = 0.5
120 months	$\rightarrow$ FS = 0.0

- **Uncertainty** is measured using two items that assess how predictable were technological changes in the environment, combined into a scale (α = .74) and recoded into a fuzzy set of firms operating in a *highly uncertain environment*

"Completely unpredictable"	$\rightarrow$	FS = 1.0
scale mid-point	$\rightarrow$	FS = 0.5
"Easily predictable"	$\rightarrow$	FS = 0.0

Table 7: Configurations for Achieving High Performance

	Solution					
	1a	**1b**	**2**	**3a**	**3b**	**4**
Structure						
Large Size	⊗	⊗	⊗	⊗	⊗	●
Formalization	●	●	⊗	⊗	⊗	●
Centralization	●	●	●	⊗	⊗	⊗
Complexity		●	⊗	●	⊗	●
Strategy						
Differentiation	●	●	●	●	●	●
Low Cost	●	●	●	⊗	⊗	
Environment						
Rate of Change	⊗		⊗	●	⊗	⊗
Uncertainty	⊗	⊗	⊗	⊗	⊗	⊗
Consistency	0.82	0.82	0.86	0.83	0.83	0.82
Raw Coverage	0.22	0.22	0.17	0.14	0.19	0.19
Unique Coverage	0.01	0.01	0.02	0.01	0.02	0.04

Overall Solution Consistency	**0.80**
Overall Solution Coverage	**0.36**

Table 8: Configurations for Achieving Very High Performance

	Solution		
	1a	1b	2
Structure			
Large Size	●	⊗	⊗
Formalization	●	●	⊗
Centralization	⊗	●	●
Complexity	●	●	⊗
Strategy			
Differentiation	●	●	●
Low Cost	●	●	●
Environment			
Rate of Change	⊗	⊗	⊗
Uncertainty	⊗	⊗	●
Consistency	0.83	0.83	0.84
Raw Coverage	0.17	0.22	0.17
Unique Coverage	0.03	0.04	0.03
Overall Solution Consistency		**0.81**	
Overall Solution Coverage		**0.27**	

Modeling the Negation of the Outcome

- In fuzzy set analysis, an important aspect relates to modeling the absence of the outcome
  - In this case that means modeling the absence of high performance; note that this is different from modeling causes leading to low performance
- Using the negation of the outcome here leads to consistency scores considerably below the acceptable level of 0.75, indicating the absence of a clear set-theoretic relationship
- Put differently: there are few configurations that consistently lead to high performance, but no consistent path to average performance high performance
- QCA thus allows for the analysis of causal asymmetry, a concept foreign to correlational methods that always conceive of causal relations in symmetric terms