Discriminant Function Analysis

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COM 531

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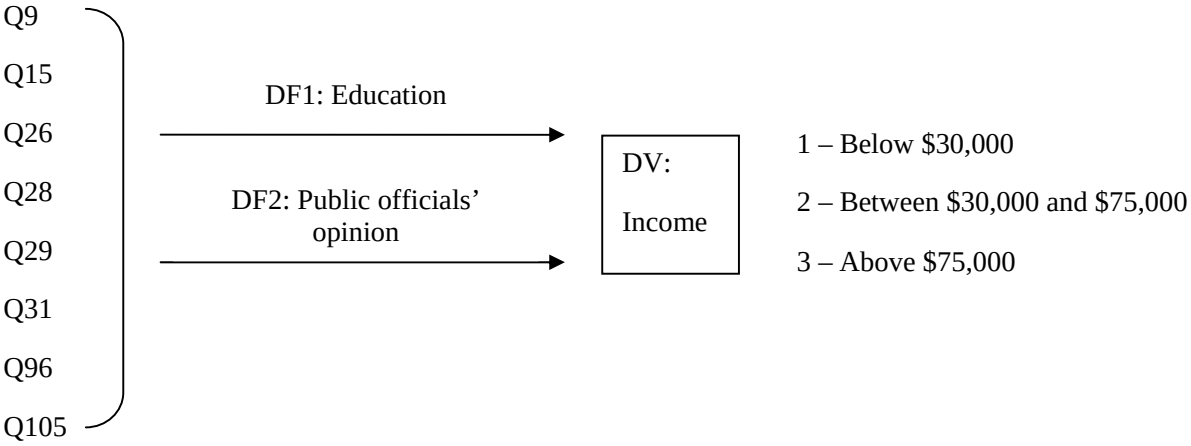
Model:

Using the National Community Data Set

IVs:



Key:

Q9 – Importance of neighborhood or community

Q15 – Importance of personal or political philosophy

Q26 - I'd feel lost if I had to move from my neighborhood

Q28 - I feel a strong identification with my community

Q29 - I enjoy living in my neighborhood.

Q31 - Public officials don't care much what people like me think.

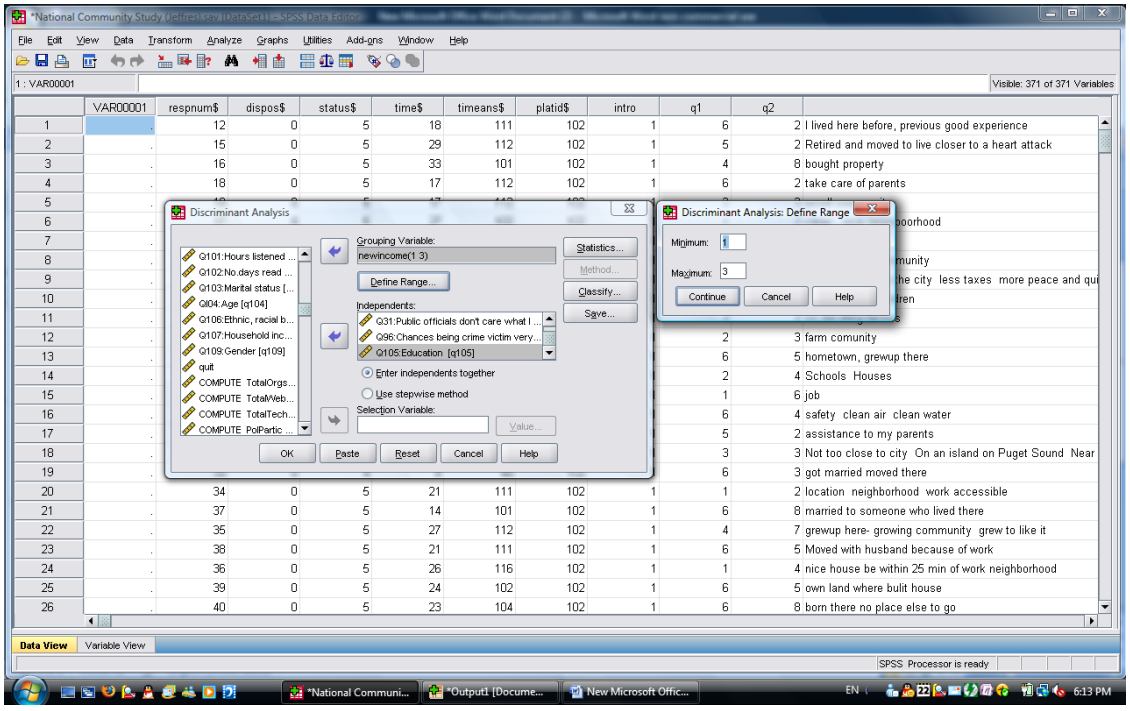
Q96 - My chances of being involved in a violent crime within the next year are very low

Q105 - Education completed

To perform Discriminant Function Analysis:

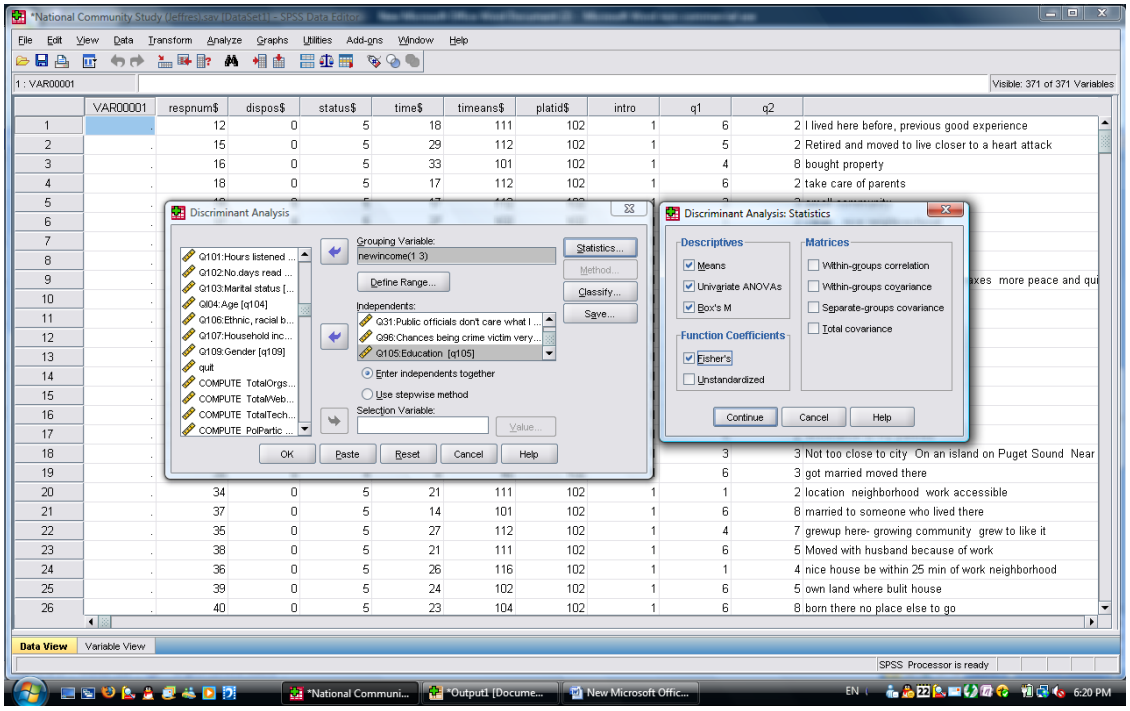
Analyze → Classify → Discriminant

- Pick your DV from the left column and click the arrow to bring it into the box labeled **Grouping Variable**.
- Click on **Define Range** and identify the minimum and maximum values (in this case, 1 and 3).
- Click **Continue**.
- Pick your IVs from the left column and click the arrow to bring them into the box labeled **Independents**.
- Underneath the **Independents** box, select **Enter Independents Together**.



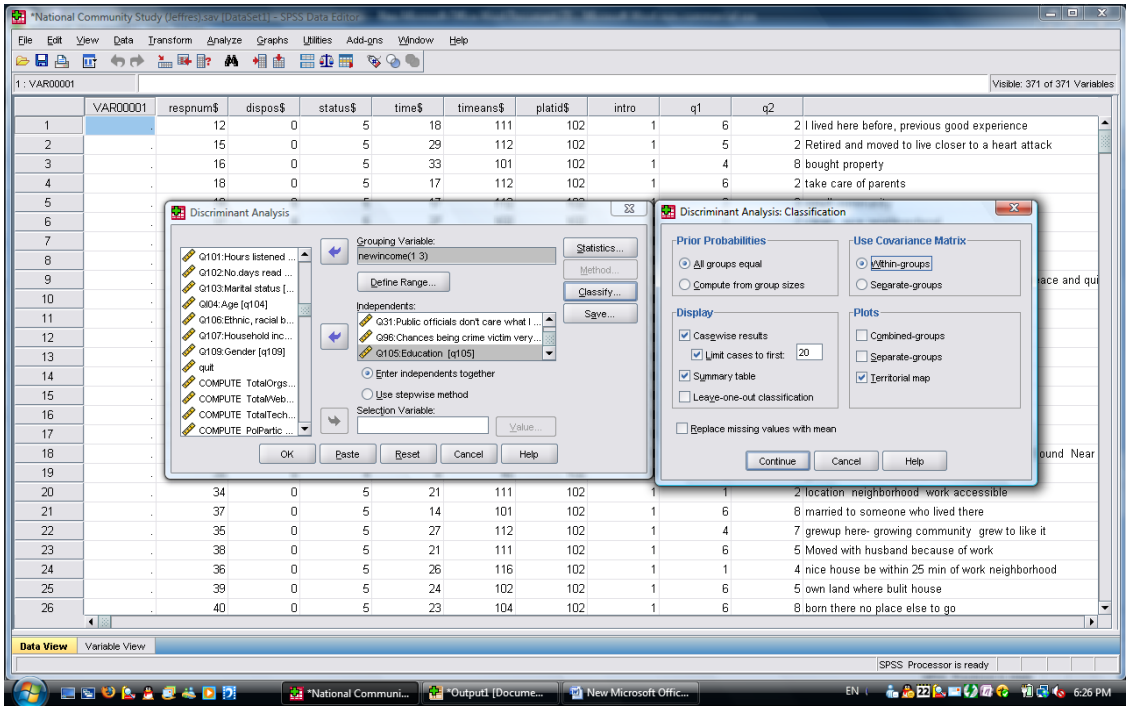
To perform Discriminant Function Analysis cont.

- Click on the **Statistics** button.
- In the **Discriminant Analysis: Statistics** window, select **Means**, **Univaritate ANOVAs**, and **Box's M**.
- Under **Functions Coefficients** check **Fisher's**.
- Click **Continue**.



To perform Discriminant Function Analysis cont.

- Click on **Classify**.
- Under **Prior Probabilities**, choose **All Groups Equal**.
- Under **Display**, select **Casewise Results**, **Limit Cases to First 20**, and **Summary Table**.
- Under **Use Covariance Matrix**, choose **Within-Groups**.
- Under **Plots**, select **Territorial Map**.
- Click **Continue** and **OK** to run the **Discriminant Analysis** output.



```
GET
  FILE='N:\COM 531\data\National Community Study (Jeffres)\National Community Study (Jeffres).sa
v'.
DATASET NAME DataSet0 WINDOW=FRONT.
DISCRIMINANT
  /GROUPS=Newincome(1 3)
  /VARIABLES=q9 q15 q26 q28 q29 q31 q96 q105
  /ANALYSIS ALL
  /PRIORS EQUAL
  /STATISTICS=MEAN STDDEV UNIVF BOXM COEFF TABLE
  /PLOT=MAP
  /PLOT=CASES(20)

  /CLASSIFY=NONMISSING POOLED.
```

Discriminant

[DataSet1] N:\COM 531\data\National Community Study (Jeffres)\National Community Study (Jeffres)

.sav

Analysis Case Processing Summary

Unweighted Cases		N	Percent
Valid		342	71.0
Excluded	Missing or out-of-range group codes	61	12.7
	At least one missing discriminating variable	17	3.5
	Both missing or out-of-range group codes and at least one missing discriminating variable	62	12.9
	Total	140	29.0
Total		482	100.0

Group Statistics

Newincome		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
1	Q9:Value neigh-community	7.02	2.509	120	120.000
	Q15:Value personal-pol.philosophy	6.32	2.960	120	120.000
	Q26:Feel lost if moved from neighborhood	5.18	4.015	120	120.000
	Q28:Feel strong ID w/community	6.28	3.228	120	120.000
	Q29:Enjoy living in neighborhood	8.04	2.696	120	120.000
	Q31:Public officials don't care what I think	4.77	3.124	120	120.000
	Q96:Chances being crime victim very low	7.07	3.687	120	120.000
	Q105:Education	3.35	1.339	120	120.000
2	Q9:Value neigh-community	7.22	2.112	140	140.000
	Q15:Value personal-pol.philosophy	6.82	2.645	140	140.000
	Q26:Feel lost if moved from neighborhood	4.72	3.711	140	140.000
	Q28:Feel strong ID w/community	6.47	3.033	140	140.000
	Q29:Enjoy living in neighborhood	8.28	2.215	140	140.000
	Q31:Public officials don't care what I think	5.03	3.230	140	140.000
	Q96:Chances being crime victim very low	7.44	3.423	140	140.000
	Q105:Education	4.25	1.126	140	140.000
3	Q9:Value neigh-community	7.34	1.814	82	82.000
	Q15:Value personal-pol.philosophy	7.33	2.079	82	82.000
	Q26:Feel lost if moved from neighborhood	4.30	3.657	82	82.000
	Q28:Feel strong ID w/community	6.93	2.909	82	82.000
	Q29:Enjoy living in neighborhood	8.43	2.250	82	82.000

	Q31:Public officials don't care what I think	3.65	3.040	82	82.000
	Q96:Chances being crime victim very low	7.95	2.828	82	82.000
	Q105:Education	4.85	1.090	82	82.000
Total	Q9:Value neigh-community	7.18	2.194	342	342.000
	Q15:Value personal-pol.philosophy	6.77	2.661	342	342.000
	Q26:Feel lost if moved from neighborhood	4.78	3.812	342	342.000
	Q28:Feel strong ID w/community	6.51	3.076	342	342.000
	Q29:Enjoy living in neighborhood	8.23	2.400	342	342.000
	Q31:Public officials don't care what I think	4.61	3.187	342	342.000
	Q96:Chances being crime victim very low	7.43	3.396	342	342.000
	Q105:Education	4.08	1.330	342	342.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
Q9:Value neigh-community	.997	.545	2	339	.580
Q15:Value personal-pol.philosophy	.979	3.568	2	339	.029
Q26:Feel lost if moved from neighborhood	.992	1.328	2	339	.266
Q28:Feel strong ID w/community	.993	1.115	2	339	.329
Q29:Enjoy living in neighborhood	.996	.672	2	339	.511
Q31:Public officials don't care what I think	.970	5.227	2	339	.006
Q96:Chances being crime victim very low	.990	1.660	2	339	.192
Q105:Education	.806	40.849	2	339	.000

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

Newincome	Rank	Log Determinant
1	8	15.491
2	8	13.598
3	8	11.315
Pooled within-groups	8	14.144

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		144.643
F	Approx.	1.938
	df1	72
	df2	2.235E5
	Sig.	.000

Tests null hypothesis of equal population covariance matrices.

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.270[a]	92.2	92.2	.461
2	.023[a]	7.8	100.0	.150

a. First 2 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	.770	87.868	16	.000
2	.978	7.611	7	.368

Standardized Canonical Discriminant Function Coefficients

	Function	
	1	2
Q9:Value neigh-community	-.009	.108
Q15:Value personal-pol.philosophy	.285	-.135
Q26:Feel lost if moved from neighborhood	-.117	.088
Q28:Feel strong ID w/community	.102	-.251
Q29:Enjoy living in neighborhood	-.019	.186
Q31:Public officials don't care what I think	-.033	.969
Q96:Chances being crime victim very low	.121	-.118
Q105:Education	.911	.295

Structure Matrix

	Function	
	1	2
Q105:Education	.944*	.105
Q15:Value personal-pol.philosophy	.278*	-.094
Q96:Chances being crime victim very low	.187*	-.129
Q26:Feel lost if moved from neighborhood	-.170*	.034
Q29:Enjoy living in neighborhood	.121*	.022
Q9:Value neigh-community	.109*	.022
Q31:Public officials don't care what I think	-.208	.914*
Q28:Feel strong ID w/community	.147	-.183*

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

*. Largest absolute correlation between each variable and any discriminant function

Functions at Group Centroids

Newincome	Function	
	1	2
1	-.635	-.088
2	.132	.177
3	.705	-.173

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		482
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	79
Used in Output		403

Prior Probabilities for Groups

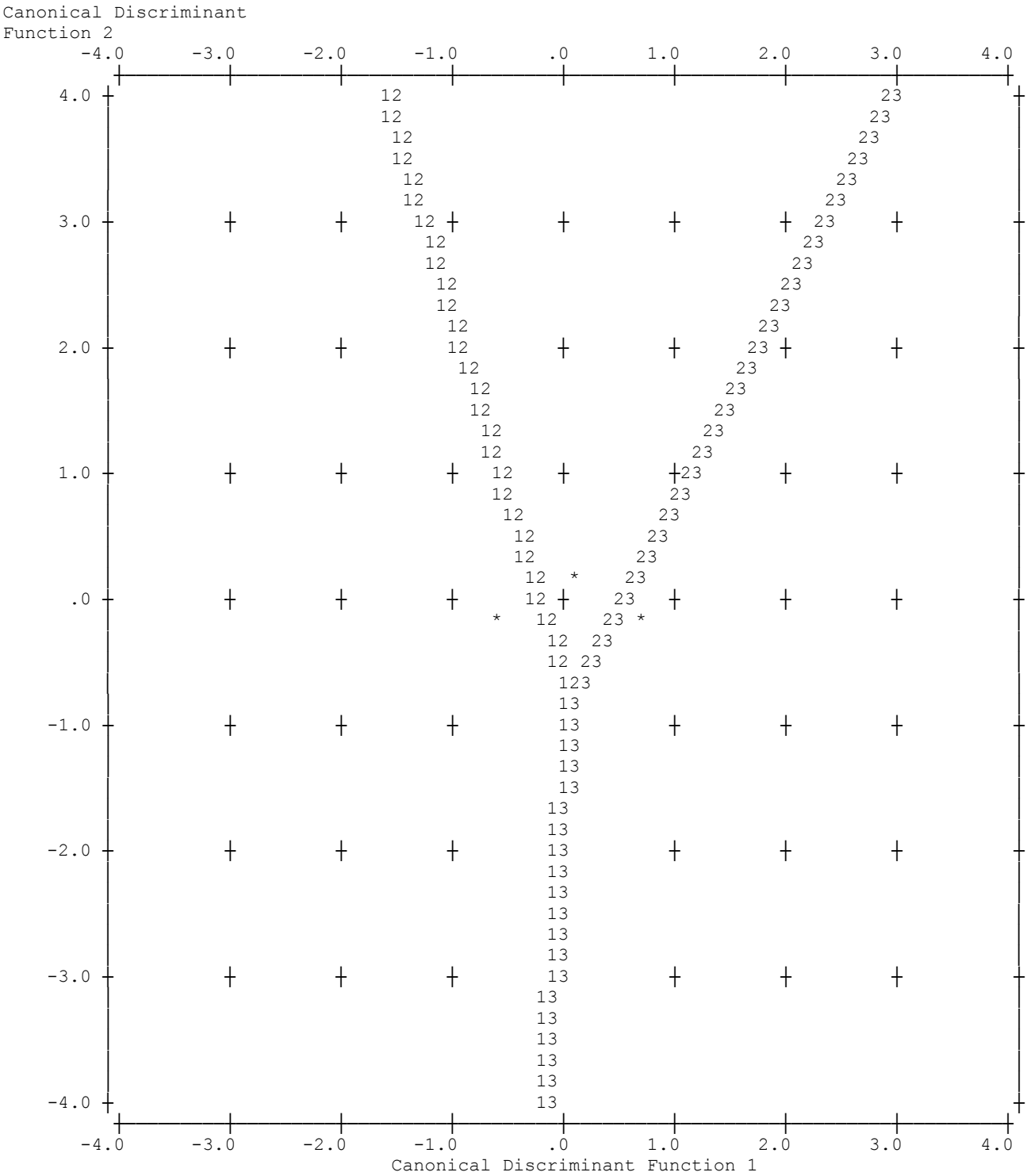
Newincome	Prior	Cases Used in Analysis	
		Unweighted	Weighted
1	.333	120	120.000
2	.333	140	140.000
3	.333	82	82.000
Total	1.000	342	342.000

Classification Function Coefficients

	Newincome		
	1	2	3
Q9:Value neigh-community	.828	.838	.819
Q15:Value personal-pol.philosophy	.657	.726	.806
Q26:Feel lost if moved from neighborhood	.052	.035	.009
Q28:Feel strong ID w/community	-.067	-.063	-.015
Q29:Enjoy living in neighborhood	.903	.917	.885
Q31:Public officials don't care what I think	.789	.863	.749
Q96:Chances being crime victim very low	.554	.573	.605
Q105:Education	2.369	3.018	3.368
(Constant)	-17.451	-20.989	-22.701

Fisher's linear discriminant functions

Territorial Map



Symbols used in territorial map

Symbol	Group	Label
1	1	
2	2	
3	3	
*		Indicates a group centroid

Casewise Statistics

	Case Number	Actual Group	Highest Group					Second Highest Group			Discriminant Scores	
			Predicted Group	P(D>d | G=g) p	P(D>d | G=g) df	P(G=g | D=d)	Squared Mahalanobis Distance to Centroid	Group	P(G=g | D=d)	Squared Mahalanobis Distance to Centroid	Function 1	Function 2
Original	1	1	1	.930	2	.432	.146	2	.332	.669	-.435	-.414
	2	2	3**	.770	2	.599	.523	2	.309	1.850	1.424	-.246
	3	1	1	.200	2	.825	3.215	2	.145	6.698	-2.421	-.246
	4	1	1	.946	2	.515	.111	2	.307	1.145	-.776	-.391
	5	3	3	.861	2	.560	.300	2	.312	1.471	1.104	-.547
	6	1	2**	.581	2	.453	1.087	3	.386	1.408	.755	1.013
	7	1	1	.342	2	.589	2.149	2	.230	4.028	-.934	-1.523
	8	2	3**	.241	2	.751	2.844	2	.197	5.523	1.959	-1.300
	9	2	2	.557	2	.458	1.171	1	.336	1.788	-.246	1.191
	10	1	1	.216	2	.554	3.066	2	.227	4.849	-.764	-1.834
	11	1	2**	.773	2	.344	.516	1	.330	.599	.001	-.529
	12	2	1**	.943	2	.532	.117	2	.302	1.245	-.848	-.356
	13	1	1	.801	2	.499	.443	2	.358	1.105	-.855	.540
	14	3	2**	.421	2	.460	1.729	1	.363	2.204	-.404	1.378
	15	3	3	.428	2	.647	1.699	2	.245	3.641	1.296	-1.335
	16	1	2**	.170	2	.503	3.540	3	.381	4.094	1.046	1.822
	17	1	3**	.181	2	.507	3.422	2	.423	3.786	1.613	1.439
	18	2	2	.188	2	.506	3.344	3	.370	3.967	.972	1.801
	20	2	1**	.975	2	.428	.050	2	.362	.389	-.484	.075
	21	1	1	.824	2	.572	.388	2	.312	1.599	-1.128	.294

**. Misclassified case

Classification Results[a]

			Predicted Group Membership			
		Newincome	1	2	3	Total
Original	Count	1	71	28	21	120
		2	40	45	55	140
		3	11	16	55	82
		Ungrouped cases	18	16	27	61
	%	1	59.2	23.3	17.5	100.0
		2	28.6	32.1	39.3	100.0
		3	13.4	19.5	67.1	100.0
		Ungrouped cases	29.5	26.2	44.3	100.0

a. 50.0% of original grouped cases correctly classified.

Table 1

Standardized discriminant function coefficients

IVs	DF1 Standardized Coefficients	DF2 Standardized Coefficients	Education DF1 Correlation	Public officials' opinion DF2 Correlation
Q9	-.009	.108	.109*	.022
Q15	.285	-.135	.278*	-.094
Q26	-.117	.088	-.170*	.034
Q28	.102	-.251	.147	-.183*
Q29	-.019	.186	.121*	.022
Q31	-.033	.969	-.208	.914*
Q96	.121	-.118	.187*	-.129
Q105	.911	.295	.944*	.105

* Indicates largest correlation between each variable and any discriminant function

Table 2

Mean Scores on Discriminant Function for 3DV groups (centroids)

Income	DF1: Education	DF2: Public officials' opinion
1 - Below $30,000	-.635	-.088
2 - Between $30,000 and 75,000	.132	.177
3 – Above $75,000	.705	-.173

Wilks' Lambda	.770	.978
Chi Square	87.868	7.611
Significance	.000	.368
Eigenvalue	.270	.023
Canonical Correlation	.461	.150

Table 3

Classification Matrix results for 3 group discriminant analysis

Actual Group		Predicted Group		
Group	Actual Group Size	1 – Below $30,000	2 - Between $30,000 and $75,000	3 – Above $75,000
1 - Below $30,000	120	**71**	28	21
2 - Between $30,000 and $75,000	140	40	**45**	55
3 - Above $75,000	82	11	16	**55**
Total	342			

50.0% of original grouped cases correctly classified

Press' Q:

$$\frac{[\boldsymbol{N-(nK)}]^{\boldsymbol{2}}}{\boldsymbol{N(K-1)}}$$

N= 342

n= 171

K= 3

$$\frac{[\boldsymbol{342-(171\times 3)}]^{\boldsymbol{2}}}{\boldsymbol{342(3-1)}}$$

$$=\frac{\boldsymbol{(342-513)^2}}{\boldsymbol{684}}$$

$$=\frac{\boldsymbol{29241}}{\boldsymbol{684}}$$

=42.75

df =1 on chi square table

Significant at less than .001

A discriminant function analysis was applied to assess how well an individual's income could be predicted from eight items from National community data set. These eight discriminating independent variables include importance of neighborhood, political philosophy, moving from neighborhoods, identification with community, enjoying neighborhoods, public officials' opinion, involved in a violent crime, and educational level. The dependent variable is income, and was recoded from original 9 choices, to include only three types of income categories: below $30,000, between $30,000 and $75,000, and above $75,000. Before recoding, the original 9 choices for income were: 10,000 or less, $10,001 to $20,000, $20,001 to $30,000, $30,001 to $40,000, $40,001 to $50,000, $50,001 to $75,000, $75,001 to $100,000, $100,001 to $150,000, and more than $150,000.

After performing the analysis, two discriminant functions were derived. The two functions were labeled "education" and "public officials' opinion". As Table 1 shows, the first function is called "education" because the variables in this function are highly correlated with the function; importance of neighborhoods or community (r =.109), political philosophy (r=.278), moving from neighborhoods (r=-.170), enjoy neighborhoods (r=.121), involved in in a violent crime (r=.187), and, primarily, educational level (r=.944). The second function called "public officials' opinion" has the following two variables are highly correlated with the function; identification with community (r=-.183) and public officials' opinion (r=.914).

Looking at Table 2, it shows that only one discriminant function was statistically significant, at a level of $p < .001$. The Wilks' Lambda examines how much the groups differ on the set of independent variables. The "education" discriminant function has a

significant value of < .001 and the Wilks' Lambda is .770. The "Public officials' opinion" function was not significant with a p value of .368 and a Wilks' Lambda value of .978.

The group centroids show a pattern which suggests that people with income above $75,000 have a higher educational level.

As shown in Table 3, overall, 50% of the subjects were correctly classified into the 3 income groups by the discriminant analysis. The Press' Q was calculated and valued at 20.64 (df=1, p<.001), indicating that our ability to predict income based on these eight items is significant beyond chance.

The model attempts to predict an individual's income groups (below $30,000, between $30,000 and $75,000, and above $75,000) based on their score of eight items. The findings suggest that people with income over $75,000 are more likely to have a high educational level. On the other hand, according to discriminant loadings, we can find that such variables as "chances of being crime victim" and "identification with community" only have small contribution in predicting dependent groups, which are out of our expectation.