

Appendix 1.A. Linking Study: 2000-2001 to the Operational Scale (2003)

Maryland High School Assessment

Linking Study

2000-2001 to the Operational Scale (2003)

March 17, 2004

Educational Testing Service

Appendix 1.A. Linking Study: 2000-2001 to the Operational Scale (2003)

Background

The Maryland High School Assessment (HSA) has been administered since 2000. While new items have been developed and there is a substantial item pool, not all items were on the operational/reporting scale - which is defined by the 2002 administration. Essentially there were two sets of items: 1.) items administered in 2000 or 2001 and not administered again in either 2002 or 2003 and 2.) items administered in 2002 or 2003 – these include both newly developed items and items previously administered in 2000 or 2001. The first set of items were on the “field test scale”, the second set of items were on the operational or reporting scale (mean 400, sd 40).

The items from 2000 and 2001 have not been linked to this new scale. Rather the items remained on the previous “field test” scale, which was defined following the 2000 administration. The intention was to administer the 2000-2001 items again and recalibrate the items prior to use on future forms. However the items were transformed to be on a 400/40 scale without a linking study. This is explained in an email from R. Clymer, Program Manager, CTB (November 26, 2003),

The psychometric council requested that all old field test items be recalibrated for the operational administration due to the quality of the field test items (e.g., high omit rates, motivation, etc.). The items were only transformed to 400/40 for the purpose of item selection in 2003.

In consideration of the large numbers of items that were on the 2000-2001 scale, MSDE requested the completion of a special linking study to help ascertain whether the items on the field test scale could be placed onto the operational scale without administering and recalibrating them again.

Method

To complete this study, items that could serve as a linking set were identified and included using a Stocking & Lord linking approach. Items that were administered first in 2000 or 2001 and again in 2003 were included. The numbers of items by administration that were included in the linking study were listed in Tables 1.A.1-1.A.5 below. The majority of the items were from the May administrations.

Table 1.A.1 Algebra (n=144)

	Jan-03	May-03
Jan-00	0	0
May-00	3	63
Jan-01	0	0
May-01	18	60

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Table 1.A.2 Biology (n=185)

	Jan-03	May-03
Jan-00	0	0
May-00	26	36
Jan-01	6	7
May-01	43	67

Table 1.A.3 English I (n=156)

	Jan-03	May-03
Jan-00	4	2
May-00	30	19
Jan-01	0	0
May-01	15	86

Table 1.A.4 Geometry (n=126)

	Jan-03	May-03
Jan-00	0	0
May-00	23	67
Jan-01	0	0
May-01	14	22

Table 1.A.5 Government (n=138)

	Jan-03	May-03
Jan-00	1	0
May-00	26	52
Jan-01	0	10
May-01	21	28

Results

Results of the Stocking and Lord linking were presented in the tables and plots that follow. All available items included in the linking were retained for all content areas, except Geometry. In this content area, six items were identified as unstable in the expected p-values and B-value plots due to the difference in expected p-values whose values were greater than .20. The correlation of the reference (anchor) and linking items after the S/L procedure for expected p-values and the B-parameters were .84 and .86, respectively. After removing these items, the correlation improved to .92 and .90 (see Table 1.A.6). It was noted that these items appeared in vastly different regions of the test books (e.g., sequence #2 in 2000 and sequence #57 in 2003) and these differences may be related to context effects.

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The results of the linking suggest that the items on the field test scale could be placed onto the operational scale. In all cases the correlation between the reference (anchor) and linking items after the S/L procedure were .90 or greater than for expected p-values and B-parameters (see Table 1.A.6). The correlation between the A-parameters is highest for government (.80) and lowest for geometry (.66). The correlation between the C-parameters is lowest for English I (.35) and Biology (.47).

Table 1.A.6 Correlations of Reference (Anchor) and Link Item Parameters

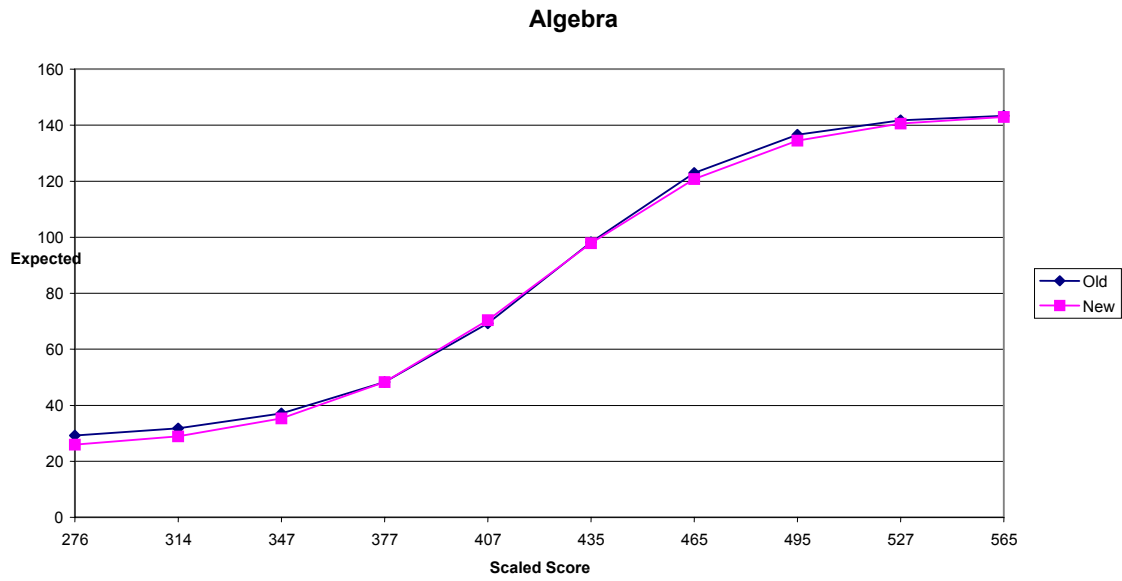
	expected p-value	B-parameter	A-parameter	C-parameter
Algebra	0.92	0.91	0.68	0.56
Biology	0.96	0.94	0.75	0.47
English I	0.94	0.90	0.71	0.35
Geometry	0.92	0.90	0.66	0.61
Government	0.92	0.90	0.80	0.55

For each content area, the following information is presented:

- Plot showing the alignment of the test characteristic curves based on the reference (anchor) and linking items after the S/L procedure.
- Transformation constants
- Bivariate plot showing the alignment of p-values estimated for the reference (anchor) and linking items after the S/L procedure. The correlation is noted in the second line of the title.
- Bivariate plot showing the alignment of the A-, B-, and C-parameters for the reference (anchor) and linking items before and after the S/L procedure. The correlation is noted in the second line of the title.
- A table of descriptive statistics (mean, sd, minimum, maximum) for the expected p-values, A-, B-, and C-parameters follows each plot.

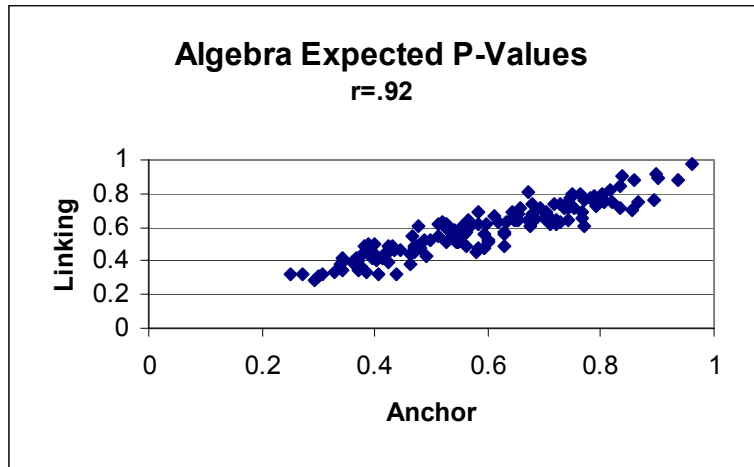
Appendix 1.A

Algebra



Transformation Constants

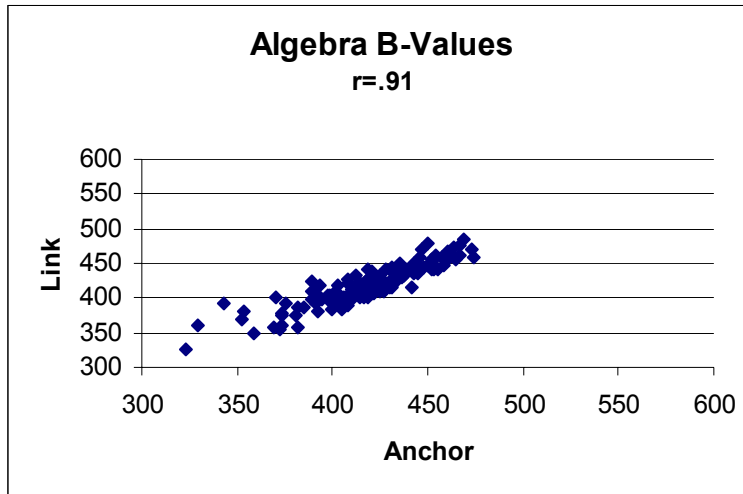
	Slope	Intercept
Algebra	0.93	50.67



Algebra Expected P-Values

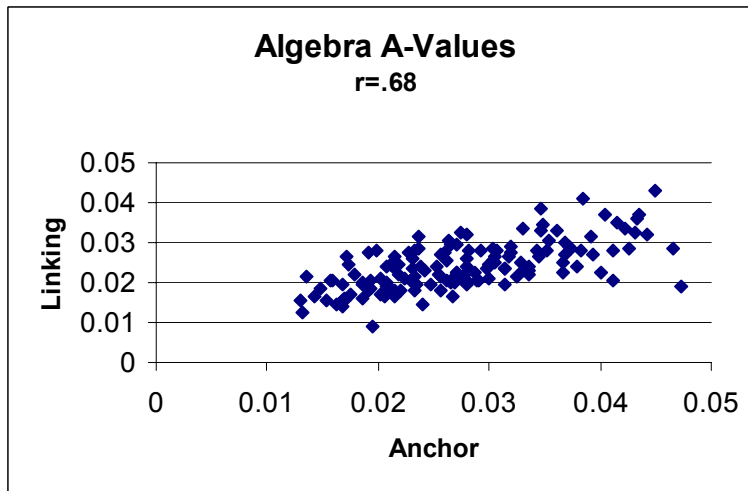
	Reference	Link
Mean	0.59	0.59
SD	0.16	0.15
Minimum	0.25	0.29
Maximum	0.96	0.97

Appendix 1.A



Algebra B-Values

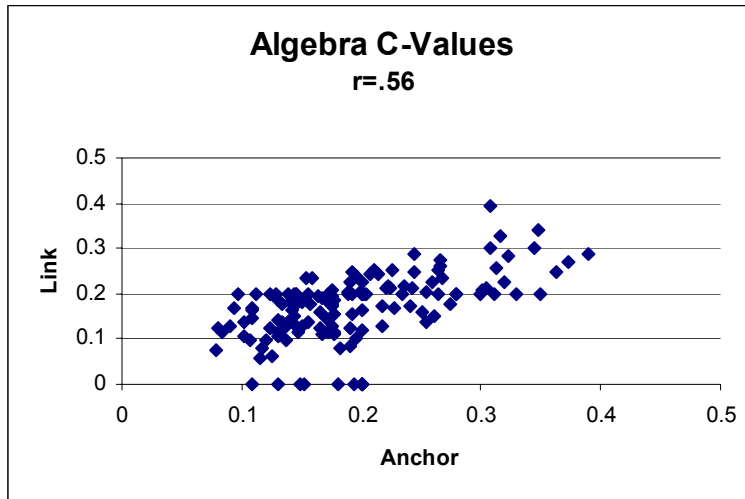
	Reference	Link
Mean	420.94	421.02
SD	29.74	29.14
Minimum	322.94	325.13
Maximum	474.44	483.68



Algebra A-Values

	Reference	Link
Mean	0.0280	0.0243
SD	0.0086	0.0061
Minimum	0.0130	0.0088
Maximum	0.0512	0.0429

Appendix 1.A

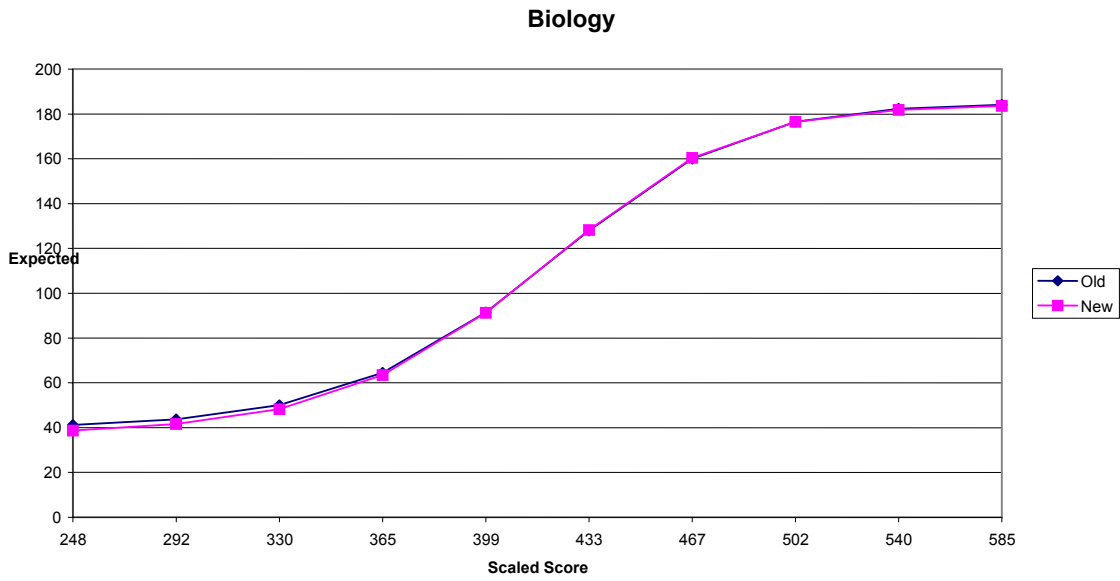


Algebra C-Values

	Reference	Link
Mean	0.19	0.17
SD	0.07	0.07
Minimum	0.08	0.00
Maximum	0.39	0.39

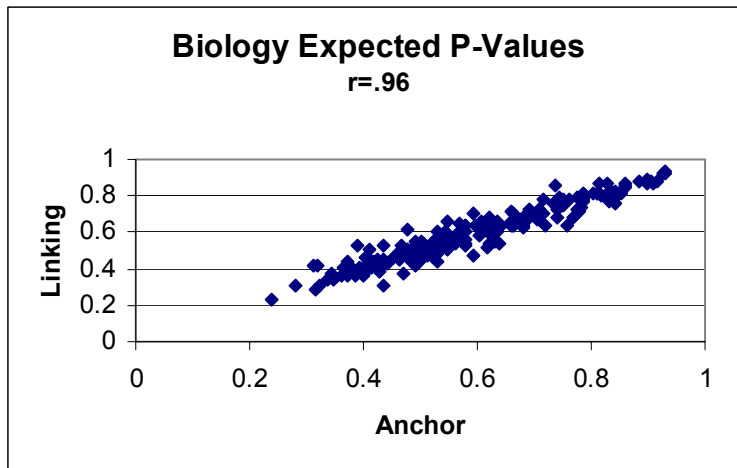
Appendix 1.A

Biology



Transformation Constants

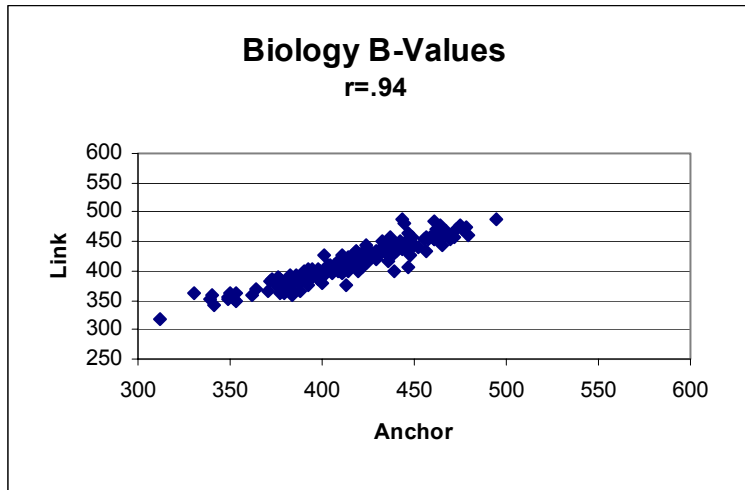
	Slope	Intercept
Biology	0.93	34.19



Biology Expected P-Values

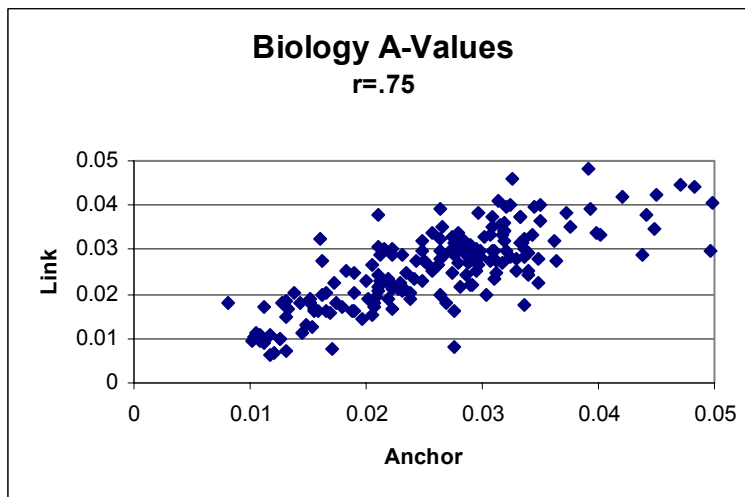
	Reference	Link
Mean	0.60	0.60
SD	0.16	0.16
Minimum	0.24	0.23
Maximum	0.93	0.94

Appendix 1.A



Biology B-Values

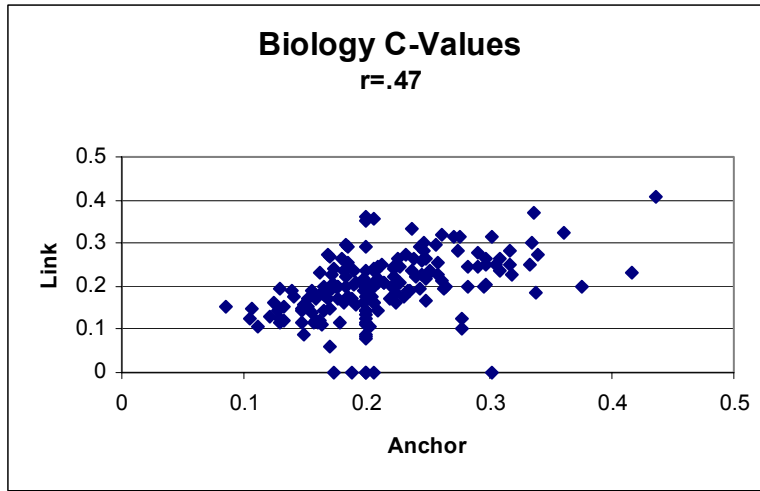
	Reference	Link
Mean	416.04	415.67
SD	34.76	35.08
Minimum	282.23	271.33
Maximum	495.07	487.84



Biology A-Values

	Reference	Link
Mean	0.026	0.026
SD	0.009	0.009
Minimum	0.008	0.006
Maximum	0.050	0.054

Appendix 1.A

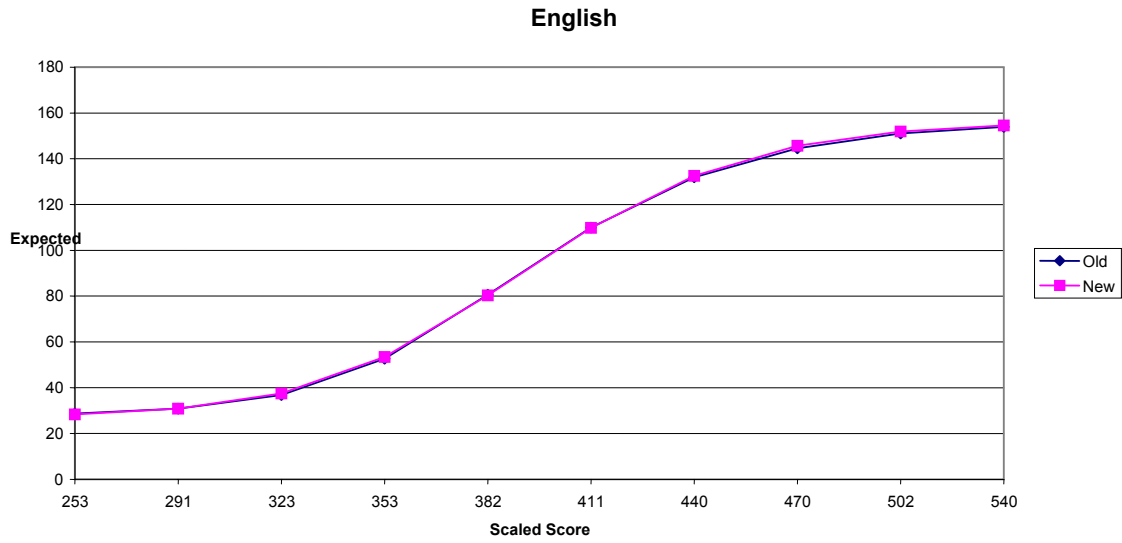


Biology C-Values

	Reference	Link
Mean	0.21	0.20
SD	0.06	0.07
Minimum	0.08	0.00
Maximum	0.44	0.41

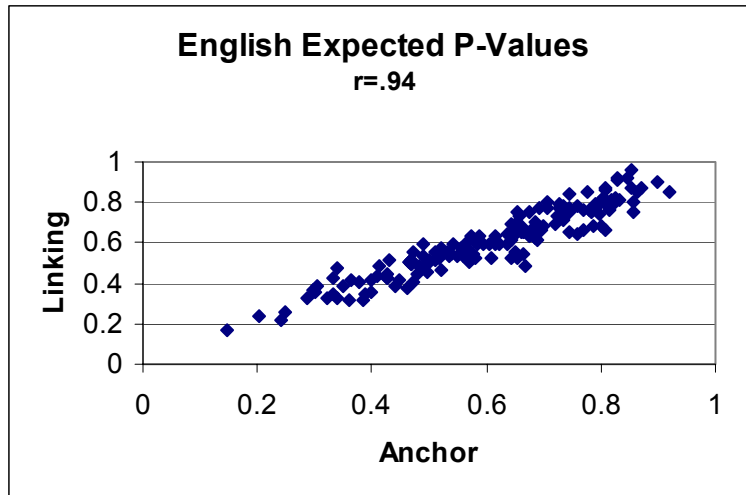
Appendix 1.A

English I



Transformation Constants

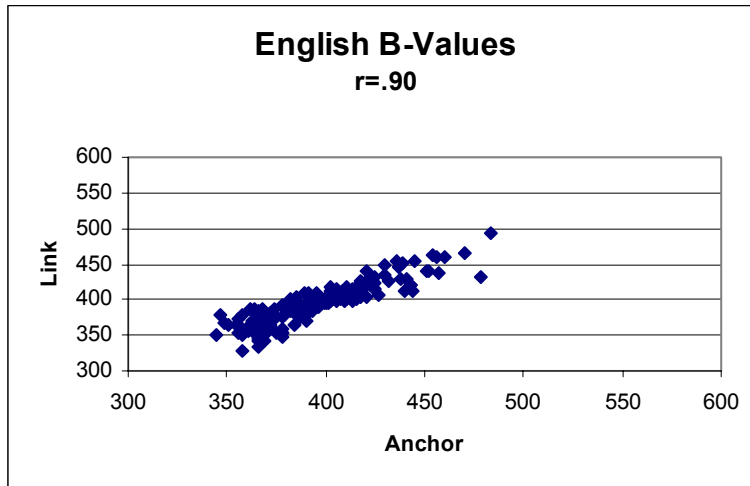
	Slope	Intercept
English I	0.80	74.89



English I Expected P-Values

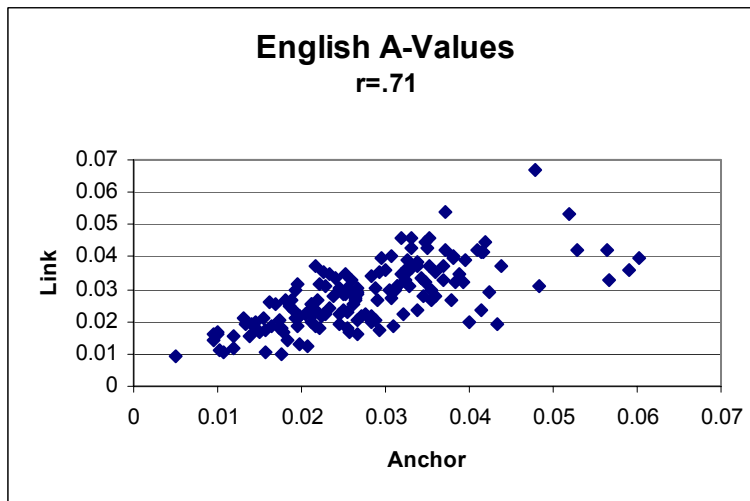
	Reference	Link
Mean	0.60	0.60
SD	0.17	0.17
Minimum	0.15	0.17
Maximum	0.92	0.96

Appendix 1.A



English I B-Values

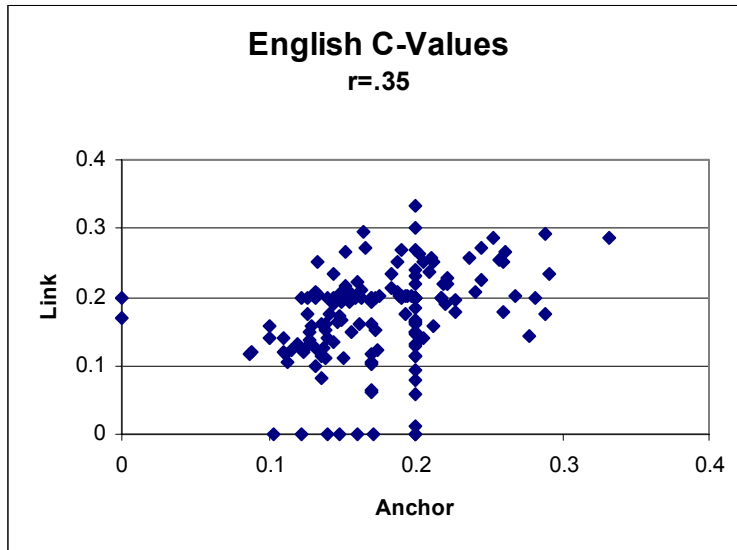
	Reference	Link
Mean	396.44	395.02
SD	29.48	29.79
Minimum	344.10	328.29
Maximum	483.00	492.34



English I A-Values

	Reference	Link
Mean	0.028	0.028
SD	0.010	0.010
Minimum	0.005	0.009
Maximum	0.060	0.067

Appendix 1.A

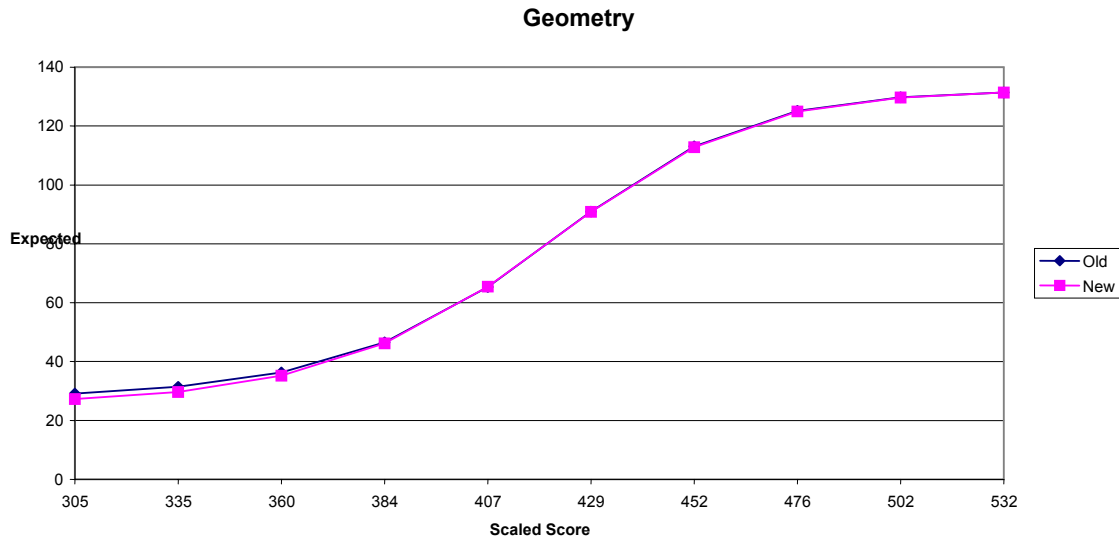


English I C-Values

	Reference	Link
Mean	0.18	0.17
SD	0.05	0.07
Minimum	0.00	0.00
Maximum	0.33	0.33

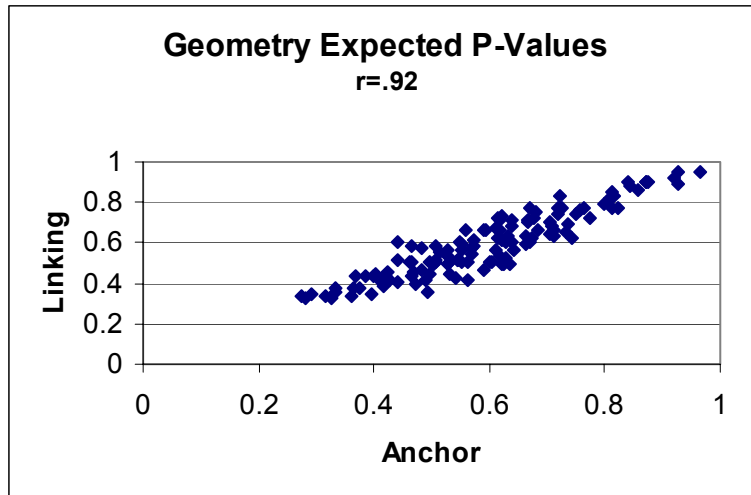
Appendix 1.A

Geometry



Transformation Constants

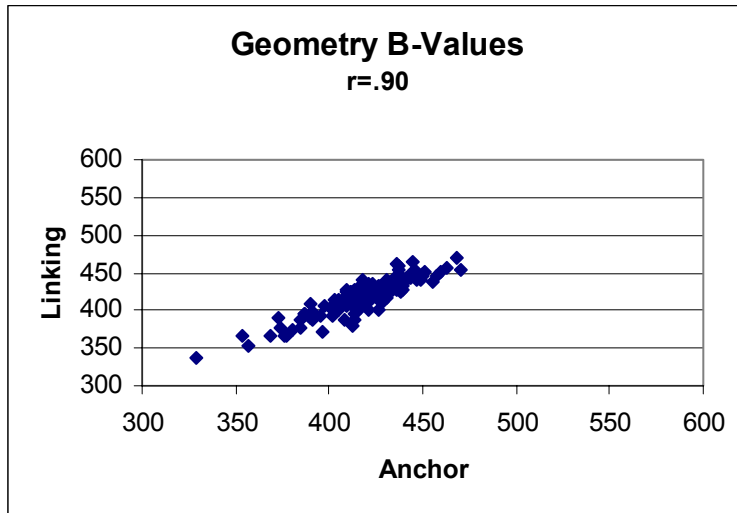
	Slope	Intercept
Geometry	0.72	113.28



Geometry Expected P-Values

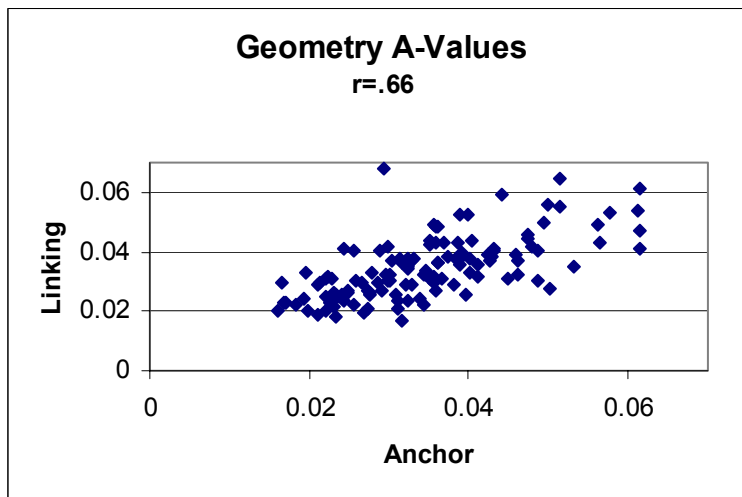
	Reference	Link
Mean	0.60	0.60
SD	0.15	0.16
Minimum	0.27	0.32
Maximum	0.96	0.95

Appendix 1.A



Geometry B-Values

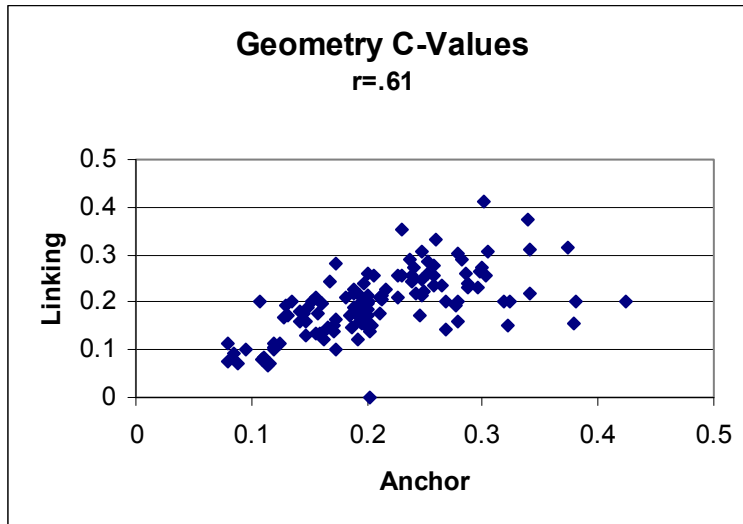
	Reference	Link
Mean	417.85	417.47
SD	23.32	24.33
Minimum	329.05	338.25
Maximum	469.84	469.20



Geometry A-Values

	Reference	Link
Mean	0.035	0.035
SD	0.011	0.010
Minimum	0.016	0.017
Maximum	0.062	0.068

Appendix 1.A

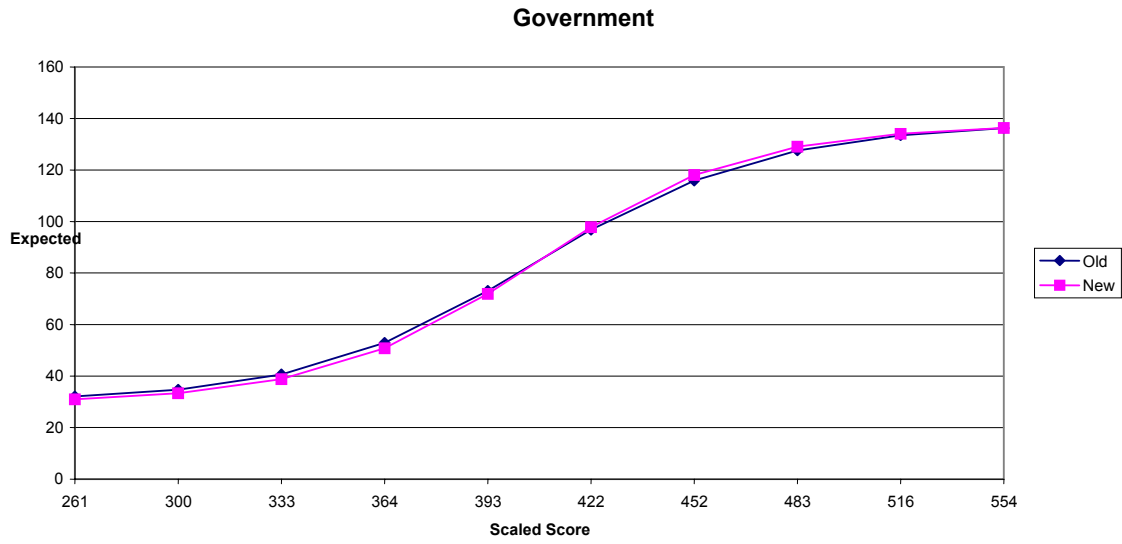


Geometry C-Values

	Reference	Link
Mean	0.21	0.20
SD	0.07	0.07
Minimum	0.08	0.00
Maximum	0.42	0.41

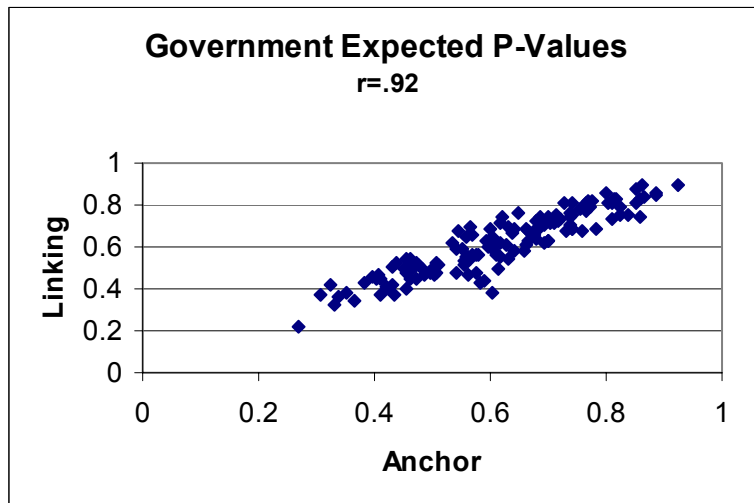
Appendix 1.A

Government



Transformation Constants

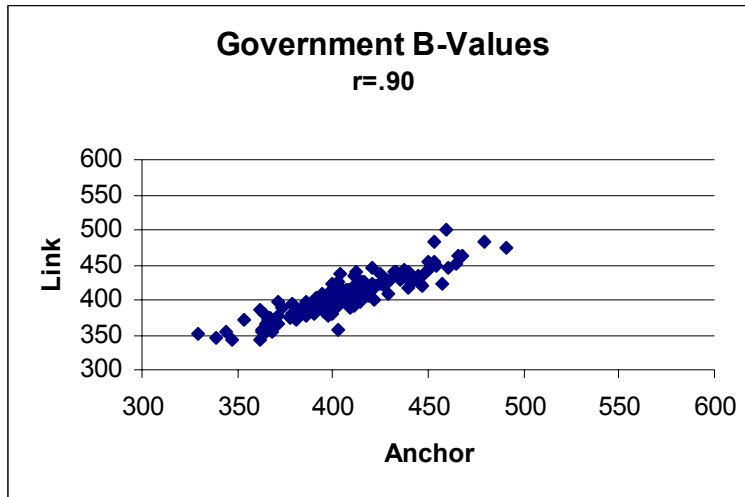
	Slope	Intercept
Government	0.99	0.34



Government Expected P-Values

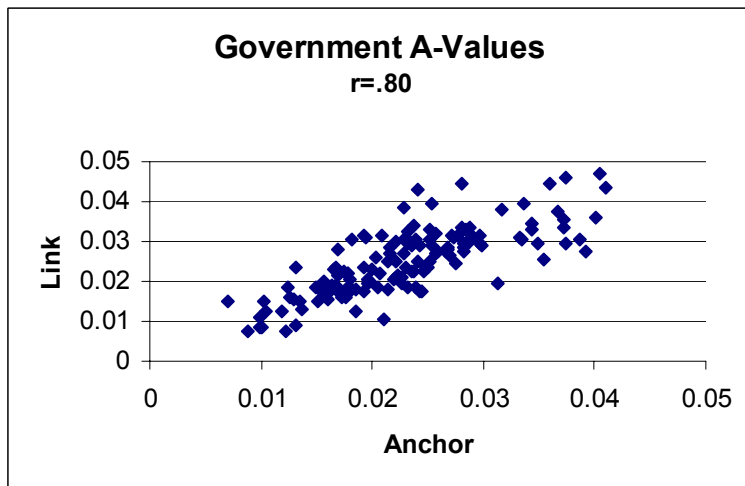
	Reference	Link
Mean	0.61	0.61
SD	0.15	0.15
Minimum	0.27	0.22
Maximum	0.92	0.90

Appendix 1.A



Government B-Values

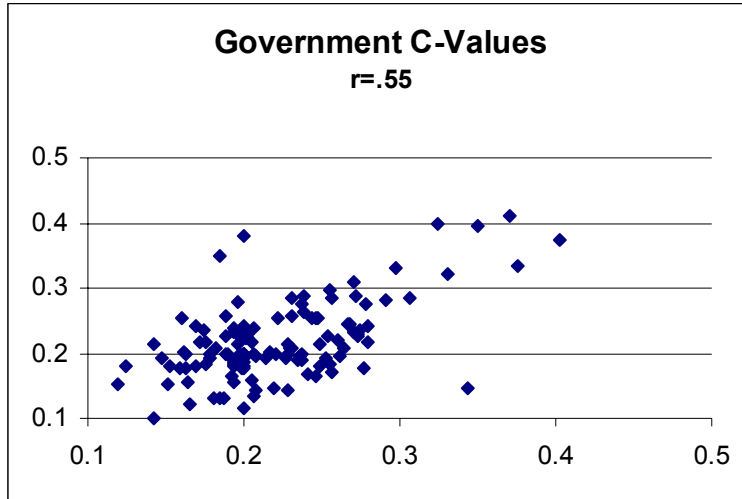
	Reference	Link
Mean	407.85	407.26
SD	30.16	30.12
Minimum	329.65	342.79
Maximum	491.29	500.15



Government A-Values

	Reference	Link
Mean	0.023	0.025
SD	0.008	0.009
Minimum	0.007	0.007
Maximum	0.049	0.050

Appendix 1.A



Government C-Values

	Reference	Link
Mean	0.22	0.21
SD	0.05	0.06
Minimum	0.12	0.00
Maximum	0.40	0.41