Making the 'Next Billion' Demand Access

The Effect of Local Content: Google.co.za in Setswana

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Abstract

Internet connectivity provides enormous improvements in quality of life as well as opportunities for the newly connected. Attempts to connect the "next billion" in Africa have not met expectations, even in places where infrastructure has come into place. This paper shows that an exogenous increase in local content creates an enormous increase in demand among native speakers, even when demand as a whole is falling as a result of the economic malaise.

The introduction of the Setswana (Tswana) language in the South-African Google Search website (google.co.za) was a side of effect of this translation work being done for the Botswanan Google Search website (google.co.bw), where Setswana is the official language, together with English. This exogenous event catalysed a huge increase in the number of internet-connected native speakers, as well as actual usage of the Setswana language online.

1 Introduction

- Effect of introduction of Setswana language on Google.co.za on number of native speakers who report paying some non-zero amount on internet in the last 30 days.
- Setswana language translation was done for Botswana (google.co.bw), so result are free of endogeneity issues.
- Setswana is also an official language of South Africa, but only a relatively small percentage of people speak it, there are also Setswana speakers in Zimbabwe and Namibia.
- Data from South Africa on 2008, 2010-2011, and 2012.
- Introduction in Botswana in late 2010, presumably some lag of information on non-internet users.

2 Methods

- Difference in Differences
- No logit because DiD [http://stats.stackexchange.com/questions/89513/difference-in-differences-estimator-for-logistic-regressions].
- Try Imbens etc.

3 Data

- NIDS in 2008, 2010-2011, and 2012

4 Results

- Base model's variable of interest (interaction of event dummy and Setswana dummy) finds strong significant result of interaction effect.
- Alternative formulation's variable of interest (interaction of event dummy and factor of categorical language variable) only significant growth only for Setswana and Venda.
- Venda not significant for computer.

```
summary(lm4_0)
```

```
##
## Call:
## lm(formula = m4_0, data = adulthh)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.13357 -0.01363 -0.00520 -0.00345  0.99802
##
## Coefficients: (1 not defined because of singularities)
##                                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)                     0.015337   0.006910   2.219  0.02646 *
## post_eventTRUE                 -0.015337   0.011607  -1.321  0.18638
## factor(a_lng)2                 -0.011977   0.007130  -1.680  0.09298 .
## factor(a_lng)3                 -0.010139   0.007031  -1.442  0.14933
## factor(a_lng)4                 -0.011884   0.007330  -1.621  0.10496
## factor(a_lng)5                 -0.001710   0.007348  -0.233  0.81596
## factor(a_lng)6                 -0.010081   0.007271  -1.386  0.16560
## factor(a_lng)7                 -0.010693   0.008477  -1.262  0.20712
## factor(a_lng)8                  0.118237   0.010196  11.597  < 2e-16 ***
## factor(a_lng)9                  0.025849   0.008567   3.017  0.00255 **
## factor(a_lng)10                 0.029305   0.007130   4.110 3.96e-05 ***
## factor(a_lng)11                 0.088444   0.007764  11.392  < 2e-16 ***
## factor(a_lng)12                 0.092771   0.021645   4.286 1.82e-05 ***
## post_eventTRUE:factor(a_lng)2   0.013953   0.011955   1.167  0.24318
## post_eventTRUE:factor(a_lng)3   0.014632   0.011794   1.241  0.21476
## post_eventTRUE:factor(a_lng)4   0.016932   0.012224   1.385  0.16603
## post_eventTRUE:factor(a_lng)5   0.013013   0.012301   1.058  0.29010
## post_eventTRUE:factor(a_lng)6   0.020708   0.012188   1.699  0.08932 .
## post_eventTRUE:factor(a_lng)7   0.024171   0.014170   1.706  0.08805 .
## post_eventTRUE:factor(a_lng)8  -0.118237   0.015523  -7.617 2.65e-14 ***
## post_eventTRUE:factor(a_lng)9  -0.023496   0.014036  -1.674  0.09413 .
## post_eventTRUE:factor(a_lng)10  0.010640   0.011962   0.890  0.37372
## post_eventTRUE:factor(a_lng)11  0.013933   0.013255   1.051  0.29321
## post_eventTRUE:factor(a_lng)12        NA         NA      NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1248 on 49276 degrees of freedom
##   (11933 observations deleted due to missingness)
## Multiple R-squared:  0.03597,Adjusted R-squared:  0.03554
## F-statistic: 83.57 on 22 and 49276 DF,  p-value: < 2.2e-16
```

4.1 LM4_1

```
summary(lm4_1)
```

```
##
## Call:
## lm(formula = m4_1, data = adulthh)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.14231 -0.01879 -0.01159  0.00079  1.01927
##
## Coefficients: (2 not defined because of singularities)
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                     0.0318595  0.0071928   4.429 9.47e-06 ***
## post_eventTRUE                 -0.0160615  0.0115788  -1.387  0.16540
## factor(a_lng)2                 -0.0099108  0.0073031  -1.357  0.17477
## factor(a_lng)3                 -0.0074446  0.0072117  -1.032  0.30194
## factor(a_lng)4                 -0.0117912  0.0075144  -1.569  0.11662
## factor(a_lng)5                 -0.0024480  0.0075095  -0.326  0.74444
## factor(a_lng)6                 -0.0090931  0.0074556  -1.220  0.22261
## factor(a_lng)7                 -0.0109606  0.0086869  -1.262  0.20705
## factor(a_lng)8                  0.1112536  0.0102699  10.833  < 2e-16 ***
## factor(a_lng)9                  0.0241967  0.0088206   2.743  0.00609 **
## factor(a_lng)10                 0.0327904  0.0073039   4.489 7.16e-06 ***
## factor(a_lng)11                 0.0832838  0.0079063  10.534  < 2e-16 ***
## factor(a_lng)12                 0.0929623  0.0216230   4.299 1.72e-05 ***
## a_edlitrden                    -0.0033726  0.0022402  -1.505  0.13220
## a_edlitwrten                   -0.0068192  0.0021992  -3.101  0.00193 **
## a_edlitrdhm                     0.0005543  0.0021514   0.258  0.79667
## a_edlitwrthm                    0.0021000  0.0021548   0.975  0.32978
## a_womanTRUE                    -0.0012292  0.0011597  -1.060  0.28918
## post_eventTRUE:factor(a_lng)2   0.0132434  0.0119238   1.111  0.26672
## post_eventTRUE:factor(a_lng)3   0.0145833  0.0117679   1.239  0.21526
## post_eventTRUE:factor(a_lng)4   0.0177728  0.0121993   1.457  0.14516
## post_eventTRUE:factor(a_lng)5   0.0129743  0.0122610   1.058  0.28998
## post_eventTRUE:factor(a_lng)6   0.0200726  0.0121631   1.650  0.09889 .
## post_eventTRUE:factor(a_lng)7   0.0253515  0.0141395   1.793  0.07299 .
## post_eventTRUE:factor(a_lng)8  -0.1117654  0.0154157  -7.250 4.23e-13 ***
## post_eventTRUE:factor(a_lng)9  -0.0181736  0.0140391  -1.294  0.19550
## post_eventTRUE:factor(a_lng)10  0.0095912  0.0119282   0.804  0.42136
## post_eventTRUE:factor(a_lng)11         NA         NA      NA       NA
## post_eventTRUE:factor(a_lng)12         NA         NA      NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1226 on 46438 degrees of freedom
##   (14767 observations deleted due to missingness)
```

```
## Multiple R-squared:  0.03921,Adjusted R-squared:  0.03867
## F-statistic: 72.89 on 26 and 46438 DF,  p-value: < 2.2e-16
```

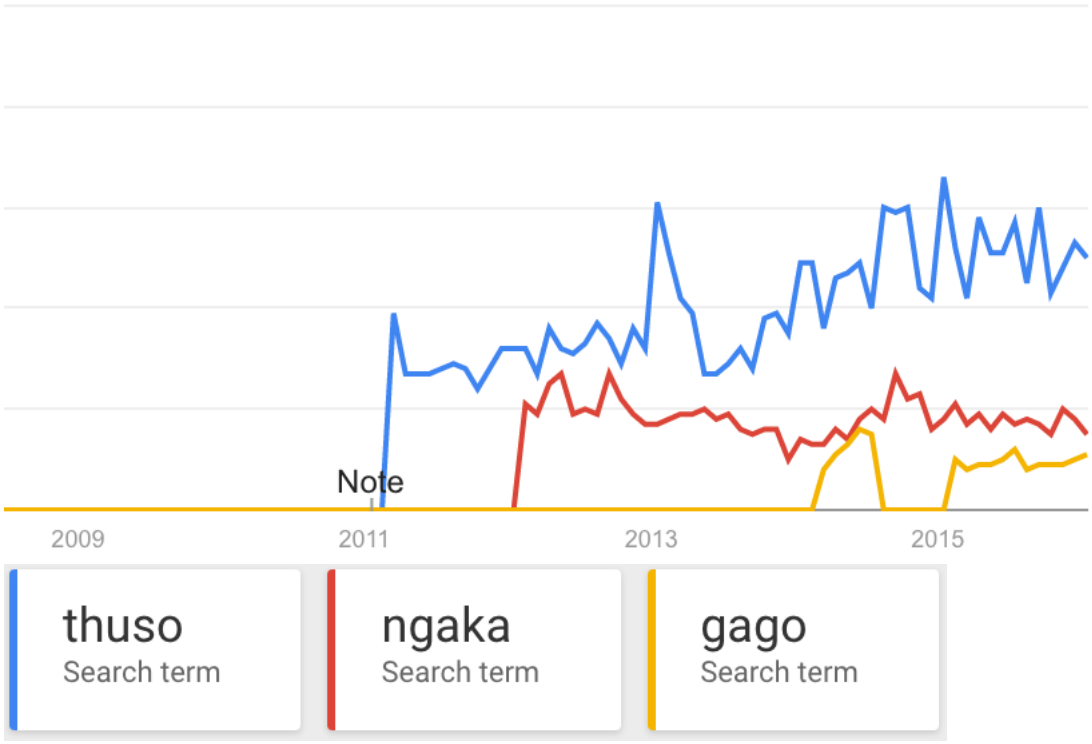
4.2 LM4_5

```
summary(lm4_5)

##
## Call:
## lm(formula = m4_5, data = adulthh)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.71081 -0.02109 -0.00980 -0.00074  1.01644
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 -7.802e-04  1.838e-03  -0.424  0.67127
## post_eventTRUE              -1.186e-02  1.219e-03  -9.728  < 2e-16 ***
## setswanaTRUE                -1.363e-02  2.430e-03  -5.609 2.04e-08 ***
## factor(a_edlitrden)2         1.540e-03  4.030e-03   0.382  0.70233
## factor(a_edlitrden)3         2.169e-04  5.283e-03   0.041  0.96724
## factor(a_edlitrden)4        -3.700e-03  6.823e-03  -0.542  0.58760
## factor(a_edlitwrten)2       -1.027e-02  4.020e-03  -2.555  0.01064 *
## factor(a_edlitwrten)3       -1.081e-02  5.229e-03  -2.067  0.03874 *
## factor(a_edlitwrten)4       -7.178e-03  6.701e-03  -1.071  0.28407
## factor(a_edlitrdhm)2        -2.615e-03  3.691e-03  -0.709  0.47857
## factor(a_edlitrdhm)3        -2.935e-03  5.139e-03  -0.571  0.56795
## factor(a_edlitrdhm)4        -8.026e-03  6.916e-03  -1.160  0.24587
## factor(a_edlitwrthm)2        8.491e-04  3.729e-03   0.228  0.81990
## factor(a_edlitwrthm)3        1.395e-03  5.147e-03   0.271  0.78640
## factor(a_edlitwrthm)4       -6.975e-03  6.920e-03  -1.008  0.31354
## a_womanTRUE                 -1.413e-03  1.147e-03  -1.232  0.21799
## hhincome                     2.753e-06  5.931e-08  46.412  < 2e-16 ***
## best_edu                     1.363e-03  1.165e-04  11.698  < 2e-16 ***
## post_eventTRUE:setswanaTRUE  1.207e-02  3.875e-03   3.114  0.00184 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1211 on 46446 degrees of freedom
##   (14767 observations deleted due to missingness)
## Multiple R-squared:  0.06175,Adjusted R-squared:  0.06139
## F-statistic: 169.8 on 18 and 46446 DF,  p-value: < 2.2e-16
```

4.3 LM2_5

```
summary(lm2_5)

##
## Call:
## lm(formula = m2_5, data = adulthh)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.6364 -0.0768 -0.0356  0.0026  1.1055
##
## Coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   7.624e-03  3.136e-03   2.431 0.015050 *
## post_eventTRUE               -5.432e-03  2.092e-03  -2.596 0.009433 **
## setswanaTRUE                 -1.480e-02  4.167e-03  -3.550 0.000385 ***
## factor(a_edlitrden)2         -3.065e-02  6.901e-03  -4.441 8.96e-06 ***
## factor(a_edlitrden)3         -3.096e-02  9.031e-03  -3.428 0.000609 ***
## factor(a_edlitrden)4         -3.900e-02  1.166e-02  -3.344 0.000825 ***
## factor(a_edlitwrten)2        -1.746e-02  6.886e-03  -2.536 0.011224 *
## factor(a_edlitwrten)3        -2.105e-02  8.937e-03  -2.355 0.018517 *
## factor(a_edlitwrten)4        -1.871e-02  1.145e-02  -1.634 0.102274
## factor(a_edlitrdhm)2         -1.869e-03  6.322e-03  -0.296 0.767476
## factor(a_edlitrdhm)3         -4.239e-03  8.803e-03  -0.482 0.630138
## factor(a_edlitrdhm)4         -2.673e-02  1.188e-02  -2.251 0.024415 *
## factor(a_edlitwrthm)2         1.227e-03  6.383e-03   0.192 0.847597
## factor(a_edlitwrthm)3        -1.998e-03  8.820e-03  -0.227 0.820792
## factor(a_edlitwrthm)4        -3.575e-02  1.189e-02  -3.008 0.002631 **
## a_womanTRUE                  -2.299e-02  1.960e-03 -11.729  < 2e-16 ***
## hhincome                      5.820e-06  1.022e-07  56.931  < 2e-16 ***
## best_edu                      5.835e-03  2.002e-04  29.143  < 2e-16 ***
## post_eventTRUE:setswanaTRUE   2.385e-02  6.684e-03   3.569 0.000359 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2097 on 47647 degrees of freedom
##   (13566 observations deleted due to missingness)
## Multiple R-squared:  0.129,Adjusted R-squared:  0.1286
## F-statistic: 391.9 on 18 and 47647 DF,  p-value: < 2.2e-16
```

Figure 1: Usage of Setswana Words on Google.co.za



4.4 Other results

5 Conclusions and Limitations

- need more local content
- need more research