THE LANCET Infectious Diseases

Supplementary webappendix

This webappendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Siroka A, Ponce NA, Lönnroth K. Association between spending on social protection and tuberculosis burden: a global analysis. *Lancet Infect Dis* 2015; published online Dec 22. http://dx.doi.org/10.1016/S1473-3099(15)00401-6.

Technical Appendix

a) Hausman – Wu test for fixed effects vs. random effects

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+------------------------------------------------------------
          SP |   -18.33428    -24.59519         6.26091        4.837126
         SP2 |    .5619346     .8138609       -.2519263        .1699151
      gdp_pc |   -1.753677    -1.756021        .0023438        .4368772
  hiv15_1000 |    5.544435     2.629303        2.915132        .9677796
  health_exp |   -2.509421    -1.749349       -.7600714        2.385334
 pop_density |   -.0157383    -.0167347        .0009964        .0693492
 foreign_pct |    12.27715     .0510066        12.22614        6.446665
  tx_success |   -.6979976    -.5823997       -.1155978        .1615951
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       15.66
                Prob>chi2 =      0.0476
```

Here we reject the null hypothesis and thus prefer the fixed effects models as the random effects model is not consistent.

b) Variance Inflation Factor

```
    Variable |       VIF       1/VIF
-------------+----------------------
      gdp_pc |      2.34    0.427371
          SP |      2.20    0.454680
  health_exp |      1.63    0.611636
 foreign_pct |      1.60    0.625646
```

```
 pop_density |      1.33    0.754002
  hiv15_1000 |      1.18    0.847576
  tx_success |      1.09    0.918013
-------------+----------------------
  Mean VIF |      1.62
```

c) Model of one year lagged social protection on TB prevalence

Prevalence	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lag_SP_1yr	-14.04969	6.763278	-2.08	0.038	-27.33777	-.7616183
lag_SP_1yr ^{2}	.4311702	.27008	1.60	0.111	-.0994666	.961807
gdp_pc	-1.367636	.7635497	-1.79	0.074	-2.867811	.1325401
hiv15_1000	6.938215	1.070568	6.48	0.000	4.834828	9.041601
health_exp	-7.484236	4.453374	-1.68	0.093	-16.23395	1.265481
pop_density	-.0112415	.0640035	-0.18	0.861	-.1369917	.1145086
foreign_pct	13.06944	6.537021	2.00	0.046	.2259003	25.91298
tx_success	-.6857974	.3769401	-1.82	0.069	-1.426386	.0547915
_cons	182.4746	55.86098	3.27	0.001	72.72232	292.2268

d) Model of one year lagged social protection on TB incidence

Incidence	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lag_SP_1yr	-6.899385	4.133453	-1.67	0.096	-15.02054	1.221771
lag_SP_1yr ^{2}	.1906778	.1650624	1.16	0.249	-.1336267	.5149824
gdp_pc	-.7523139	.4666519	-1.61	0.108	-1.669163	.1645353
hiv15_1000	7.880551	.6542895	12.04	0.000	6.595043	9.166059
health_exp	-4.471112	2.721729	-1.64	0.101	-9.8186	.8763752
pop_density	.0052164	.0391165	0.13	0.894	-.0716372	.08207
foreign_pct	5.781611	3.995173	1.45	0.148	-2.067862	13.63108
tx_success	-.246863	.2303712	-1.07	0.284	-.6994822	.2057562
_cons	79.65325	34.14006	2.33	0.020	12.57695	146.7296

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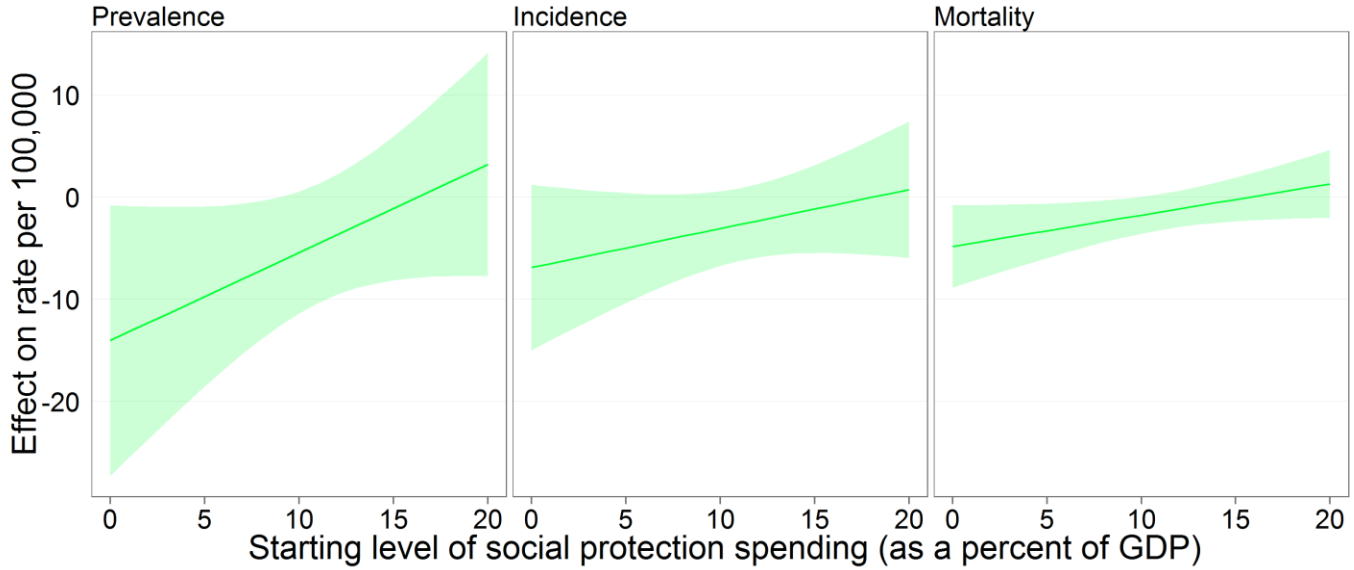
-------------+----------------------------------------------------------------
```

e) Model of one year lagged social protection on TB mortality

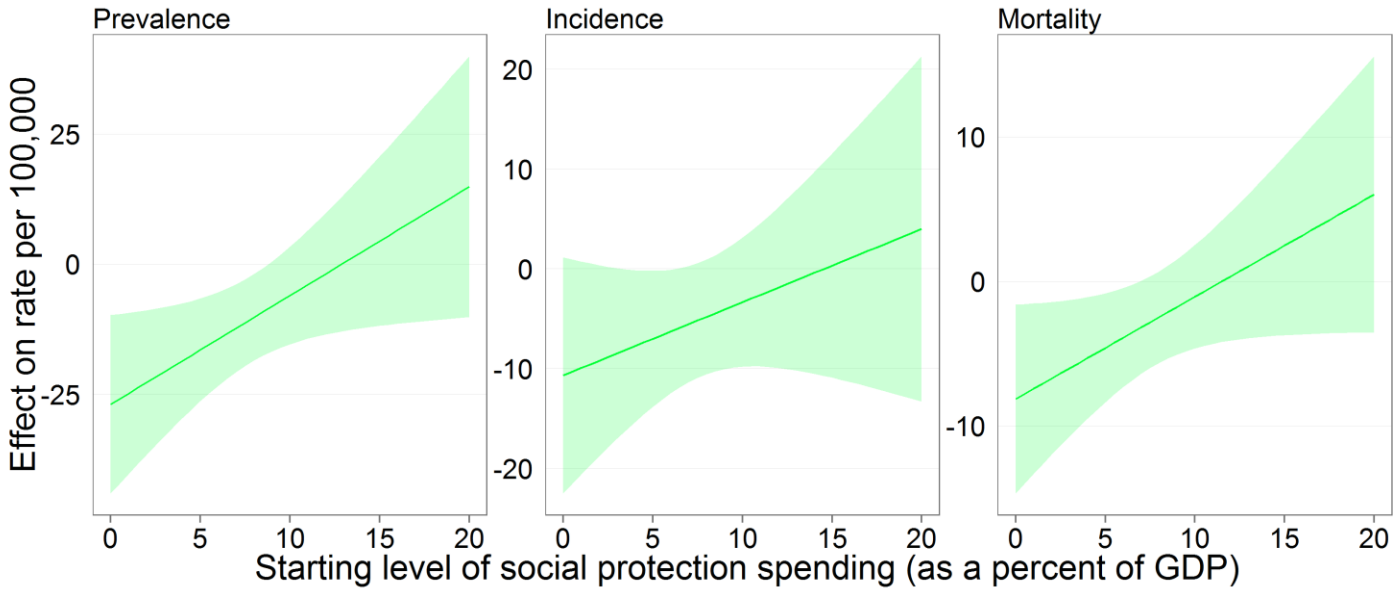
```
------------------------------------------------------------------------------
  Mortality  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lag_SP_1yr |  -4.837762   2.051671    -2.36   0.019     -8.86876   -.8067628
              |
  lag_SP_1yr^2 |   .1531965     .08193     1.87   0.062    -.0077746    .3141676
              |
       gdp_pc |  -.1587676   .2316263    -0.69   0.493    -.6138528    .2963176
   hiv15_1000 |   3.988148   .3247617    12.28   0.000     3.350076     4.62622
   health_exp |  -1.906305   1.350951    -1.41   0.159    -4.560572    .7479621
  pop_density |    .003986   .0194158     0.21   0.837    -.0341609    .0421329
  foreign_pct |   1.169915   1.983035     0.59   0.555    -2.726231    5.066062
   tx_success |    -.19776   .1143465    -1.73   0.084     -.422421     .026901
        _cons |   16.44977   16.94568     0.97   0.332    -16.84407    49.74361
-------------+----------------------------------------------------------------
```

f) **Effect of a one percent of GDP increase in social protection spending (lagged one year) with 95% confidence bands (N=664)***

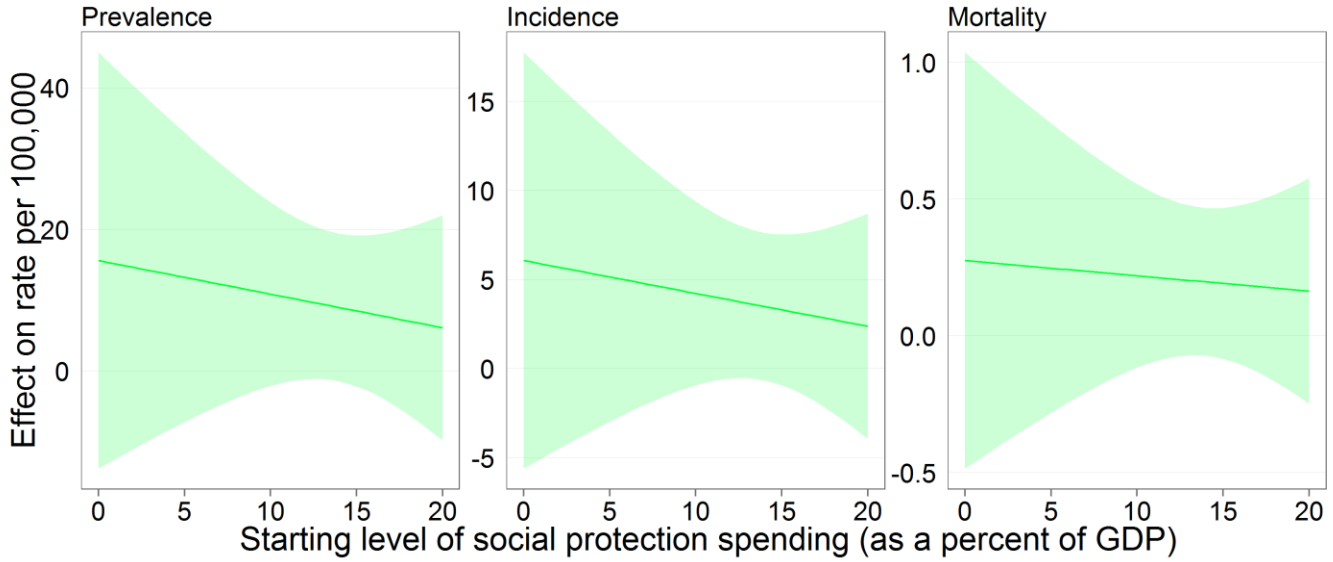


*Models adjusted for GDP per capita, levels of health expenditure, adult HIV rate, percent of population foreign-born, population density, TB treatment success rate, and country-level fixed effects. Social protection and its squared term are not jointly significant at the .05 level in any of these models with p-values of 0·097, 0·183, 0·054 for prevalence, incidence rate, and mortality rate models, respectively.

g) **Effect of a one percent of GDP increase in social protection spending with 95% confidence bands (non-Europe only)**



h) **Effect of a one percent of GDP increase in social protection spending with 95% confidence bands (Europe only)**



i) Univariate regressions on complete sample compared with only those with full covariate data

```
. reg Prevalence SP

      Source |       SS       df       MS              Number of obs =     803
-------------+------------------------------           F(  1,   801) =  168.28
       Model |  7205355.24     1  7205355.24           Prob > F      =  0.0000
    Residual |  34295983.7   801  42816.4591           R-squared     =  0.1736
-------------+------------------------------           Adj R-squared =  0.1726
       Total |    41501339   802  51747.3054           Root MSE      =  206.92

------------------------------------------------------------------------------
 Prevalence  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -15.30435   1.179757   -12.97   0.000    -17.62013   -12.98857
       _cons |   266.1382   10.58296    25.15   0.000     245.3646    286.9118
```

```
. reg Incidence SP

      Source |       SS       df       MS              Number of obs =     803
-------------+------------------------------           F(  1,   801) =  121.65
       Model |  4191735.73     1  4191735.73           Prob > F      =  0.0000
    Residual |  27600000.3   801  34456.9292           R-squared     =  0.1318
-------------+------------------------------           Adj R-squared =  0.1308
       Total |    31791736   802  39640.5686           Root MSE      =  185.63

------------------------------------------------------------------------------
  Incidence  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -11.67304   1.058341   -11.03   0.000    -13.75049   -9.595596
       _cons |   203.2515   9.493796    21.41   0.000     184.6159    221.8872
------------------------------------------------------------------------------

. reg Mortality SP

      Source |       SS       df       MS              Number of obs =     803
-------------+------------------------------           F(  1,   801) =   76.48
       Model |  309654.953     1  309654.953           Prob > F      =  0.0000
    Residual |  3243314.52   801   4049.0818           R-squared     =  0.0872
-------------+------------------------------           Adj R-squared =  0.0860
       Total |  3552969.47   802   4430.1365           Root MSE      =  63.632

------------------------------------------------------------------------------
 Mortality   |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -3.172679   .3627985    -8.75   0.000    -3.884828   -2.460531
       _cons |   48.44498   3.254467    14.89   0.000     42.05669    54.83327
```

```
. reg Prevalence SP

      Source |       SS       df       MS              Number of obs =     664
-------------+------------------------------           F(  1,   662) =  200.39
       Model |  8714903.26     1  8714903.26           Prob > F      =  0.0000
    Residual |  28790574.4   662  43490.2937           R-squared     =  0.2324
-------------+------------------------------           Adj R-squared =  0.2312
```

```
       Total |  37505477.7   663  56569.3479           Root MSE      =  208.54

------------------------------------------------------------------------------
 Prevalence  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -18.05844    1.27569   -14.16   0.000    -20.56332   -15.55355
       _cons |   308.8554   11.97469    25.79   0.000     285.3425    332.3684
------------------------------------------------------------------------------
```

```
. reg Incidence SP

      Source |       SS       df       MS              Number of obs =     664
-------------+------------------------------           F(  1,   662) =  138.43
       Model |  5047337.76     1  5047337.76           Prob > F      =  0.0000
    Residual |  24137759.1   662  36461.8717           R-squared     =  0.1729
-------------+------------------------------           Adj R-squared =  0.1717
       Total |  29185096.8   663  44019.7539           Root MSE      =  190.95

------------------------------------------------------------------------------
  Incidence  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -13.74295   1.168069   -11.77   0.000    -16.03652   -11.44939
       _cons |   235.8316   10.96446    21.51   0.000     214.3023    257.3609
------------------------------------------------------------------------------
```

```
. reg Mortality SP

      Source |       SS       df       MS              Number of obs =     664
-------------+------------------------------           F(  1,   662) =   85.80
       Model |  388039.045     1  388039.045           Prob > F      =  0.0000
    Residual |  2993898.72   662  4522.50562           R-squared     =  0.1147
-------------+------------------------------           Adj R-squared =  0.1134
       Total |  3381937.76   663  5100.96193           Root MSE      =   67.25

------------------------------------------------------------------------------
 Mortality   |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -3.810541   .4113755    -9.26   0.000    -4.618299   -3.002783
       _cons |   58.21057   3.861513    15.07   0.000     50.62828    65.79286
------------------------------------------------------------------------------
```

```
. reg Prevalence SP

      Source |       SS       df       MS              Number of obs =     139
-------------+------------------------------           F(  1,   137) =    3.86
       Model |  78499.7889     1  78499.7889           Prob > F      =  0.0516
    Residual |  2788955.53   137  20357.3396           R-squared     =  0.0274
-------------+------------------------------           Adj R-squared =  0.0203
       Total |  2867455.32   138  20778.6617           Root MSE      =  142.68

------------------------------------------------------------------------------
 Prevalence  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -4.844857   2.467216    -1.96   0.052    -9.723607    .0338936
       _cons |   106.4458   16.35745     6.51   0.000     74.10001    138.7915
------------------------------------------------------------------------------


. reg Incidence SP

      Source |       SS       df       MS              Number of obs =     139
-------------+------------------------------           F(  1,   137) =    4.00
       Model |  54683.2722     1  54683.2722           Prob > F      =  0.0476
    Residual |  1874158.38   137  13679.9882           R-squared     =  0.0284
-------------+------------------------------           Adj R-squared =  0.0213
       Total |  1928841.66   138  13977.1135           Root MSE      =  116.96

------------------------------------------------------------------------------
  Incidence  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -4.043653   2.022505    -2.00   0.048    -8.043017   -.0442895
       _cons |   81.99572   13.40905     6.11   0.000     55.48025    108.5112
------------------------------------------------------------------------------


. reg Mortality SP

      Source |       SS       df       MS              Number of obs =     139
-------------+------------------------------           F(  1,   137) =    2.01
       Model |  1581.94054     1  1581.94054           Prob > F      =  0.1589
    Residual |  107994.351   137  788.279936           R-squared     =  0.0144
-------------+------------------------------           Adj R-squared =  0.0072
```

```
       Total |  109576.292   138    794.0311           Root MSE      =  28.076

------------------------------------------------------------------------------
 Mortality   |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SP |  -.6877677   .4854974    -1.42   0.159    -1.647805    .2722701
       _cons |   11.79203   3.218811     3.66   0.000     5.427058    18.15701
```

j) Models only including significant variables

```
------------------------------------------------------------------------------
      Prevalence  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------
              SP  |  -21.84089   6.721289    -3.25   0.001    -35.04546    -8.63631
                  |
             SP2  |   .7333698   .2732467     2.68   0.008     .1965521    1.270187
                  |
          gdp_pc  |  -1.520214   .7509702    -2.02   0.043    -2.995562   -.0448652
       hiv15_1000 |   5.659381   1.030505     5.49   0.000      3.63486    7.683901
            _cons |    208.408   31.31447     6.66   0.000     146.8879    269.9281
------------------+-----------------------------------------------------------
         sigma_u  |  216.83721
         sigma_e  |  83.584533
             rho  |  .87063408   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(145, 514) =    17.31            Prob > F = 0.0000


------------------------------------------------------------------------------
       Incidence  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------
              SP  |  -9.877333   3.796065    -2.60   0.010    -17.33458   -2.420089
                  |
             SP2  |   .2841147   .1532936     1.85   0.064    -.0170255     .585255
                  |
       hiv15_1000 |    7.23243   .5834719    12.40   0.000     6.086219    8.378641
            _cons |   81.44232   17.77529     4.58   0.000     46.52334    116.3613
------------------+-----------------------------------------------------------


------------------------------------------------------------------------------
      Mortality   |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
```

SP	-5.800782	1.892717	-3.06	0.002	-9.519178	-2.082387
SP^2	.1772475	.0771118	2.30	0.022	.0257552	.3287398
hiv15_1000	3.468475	.2883356	12.03	0.000	2.902016	4.034933
tx_success	-.29663	.1285887	-2.31	0.021	-.5492529	-.0440072
_cons	30.01912	12.80489	2.34	0.019	4.862875	55.17537

k) Models without treatment success rate measure

Prevalence	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SP	-19.35604	6.883276	-2.81	0.005	-32.8783	-5.833771
SP^2	.6117568	.2782257	2.20	0.028	.0651795	1.158334
gdp_pc	-1.38356	.6986723	-1.98	0.048	-2.756109	-.0110111
hiv15_1000	5.594572	1.020126	5.48	0.000	3.590524	7.598619
health_exp	-3.684139	4.558839	-0.81	0.419	-12.64002	5.271747
pop_density	-.0226342	.0727631	-0.31	0.756	-.165578	.1203096
foreign_pct	11.88518	6.725175	1.77	0.078	-1.326498	25.09685
_cons	157.5685	52.09245	3.02	0.003	55.23235	259.9047

Incidence	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SP	-8.374809	3.942451	-2.12	0.034	-16.11979	-.629824

SP^2	.2425585	.159356	1.52	0.129	-.0704979	.555615
gdp_pc	-.722156	.4001701	-1.80	0.072	-1.508294	.0639822
hiv15_1000	7.231679	.5842851	12.38	0.000	6.083845	8.379513
health_exp	-2.246516	2.611111	-0.86	0.390	-7.37607	2.883039
pop_density	-.0035022	.0416756	-0.08	0.933	-.0853744	.07837
foreign_pct	5.308902	3.851897	1.38	0.169	-2.258189	12.87599
_cons	67.80413	29.83637	2.27	0.023	9.190288	126.418

Mortality	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SP	-5.480425	1.966043	-2.79	0.006	-9.342965	-1.617885
SP^2	.1775206	.080211	2.21	0.027	.0199361	.3351052
gdp_pc	-.1680805	.2316958	-0.73	0.469	-.6232762	.2871153
hiv15_1000	3.465532	.2897895	11.96	0.000	2.896204	4.03486
health_exp	-1.150327	1.319518	-0.87	0.384	-3.742688	1.442034
pop_density	.0071206	.0207081	0.34	0.731	-.0335632	.0478043
foreign_pct	.5149366	1.925063	0.27	0.789	-3.267092	4.296965
tx_success	-.2805772	.1297184	-2.16	0.031	-.5354253	-.025729
_cons	32.5183	17.10741	1.90	0.058	-1.091374	66.12798

l) Models with GDP and GDP^2 term

Prevalence	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SP	-17.0452	6.924825	-2.46	0.014	-30.64995	-3.440437
SP^2	.572345	.2821405	2.03	0.043	.0180418	1.126648
gdp_pc	-7.513893	1.827832	-4.11	0.000	-11.10492	-3.92287
gdp_pc^2	.0733616	.0208373	3.52	0.000	.0324239	.1142993
hiv15_1000	5.641233	1.019644	5.53	0.000	3.638004	7.644461
health_exp	-.4651201	4.677308	-0.10	0.921	-9.654325	8.724085
pop_density	-.0053345	.0728963	-0.07	0.942	-.1485493	.1378802

foreign_pct	10.50251	6.789735	1.55	0.123	-2.836847	23.84186
c_new_tsr	-.7565626	.45656	-1.66	0.098	-1.653537	.1404113
_cons	229.4136	60.5615	3.79	0.000	110.4323	348.3949

Incidence	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SP	-7.56666	3.992768	-1.90	0.059	-15.41099	.2776739
SP^2	.2372112	.1626787	1.46	0.145	-.0823932	.5568155
gdp_pc	-3.545821	1.053905	-3.36	0.001	-5.61636	-1.475282
gdp_pc^2	.03373	.0120145	2.81	0.005	.0101258	.0573341
hiv15_1000	7.268257	.5879139	12.36	0.000	6.11322	8.423293
health_exp	-.9313843	2.696877	-0.35	0.730	-6.229766	4.366997
pop_density	.0037533	.0420311	0.09	0.929	-.0788226	.0863291
foreign_pct	4.732935	3.914877	1.21	0.227	-2.958371	12.42424
c_new_tsr	-.1719641	.2632468	-0.65	0.514	-.6891481	.3452199
_cons	88.3777	34.91901	2.53	0.012	19.77457	156.9808

Mortality	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SP	-5.32431	1.96638	-2.71	0.007	-9.18753	-1.46109
SP^2	.1787814	.0801169	2.23	0.026	.0213809	.3361818
gdp_pc	-.8656717	.5190327	-1.67	0.096	-1.885382	.1540385
gdp_pc^2	.0088845	.005917	1.50	0.134	-.0027402	.0205092
hiv15_1000	3.477255	.289539	12.01	0.000	2.908416	4.046094
health_exp	-.9027518	1.328173	-0.68	0.497	-3.512127	1.706623
pop_density	.0083805	.0206997	0.40	0.686	-.0322869	.0490479
foreign_pct	.3000191	1.928019	0.16	0.876	-3.487836	4.087875

```
            c_new_tsr |  -.2876697   .1296452    -2.22   0.027    -.5423752   -.0329641
                _cons |   35.44332    17.1971     2.06   0.040     1.657288    69.22936
------------------+------------------------------------------------------------------
```

m) GDP per capita as a predictor of social protection spending

```
------------------------------------------------------------------------------
          SP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gdp_pc |   .1989086   .0105958    18.77   0.000     .1781095    .2197078
       _cons |   4.064813    .222878    18.24   0.000     3.627312    4.502313
------------------------------------------------------------------------------
```

n) Karlson, Holm, Breen tests mediation of social protection on pathway from GDP per capita to TB burden

```
------------------------------------------------------------------------------
 Prevalence  |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
gdp_pc       |
     Reduced |    -3.3992   .6143293    -5.53   0.000    -4.603263   -2.195137
        Full |  -1.613236   .6774309    -2.38   0.017    -2.940976   -.2854954
        Diff |  -1.785964   .3221076    -5.54   0.000    -2.417284   -1.154645
------------------------------------------------------------------------------

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  Incidence  |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
gdp_pc       |
     Reduced |  -1.987059    .383414    -5.18   0.000    -2.738537   -1.235581
        Full |  -1.222266   .4227969    -2.89   0.004    -2.050932   -.3935989
        Diff |  -.7647933   .1892866    -4.04   0.000    -1.135788   -.3937984
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  Mortality  |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
gdp_pc       |
     Reduced |  -.3981211   .1432451    -2.78   0.005    -.6788764   -.1173659
        Full |  -.1751611   .1579587    -1.11   0.267    -.4847545    .1344323
        Diff |    -.22296   .0691262    -3.23   0.001    -.3584447   -.0874752
------------------------------------------------------------------------------
```