"Combating Political Corruption with Policy Bundles"
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Instructions for Replication

The results presented in this paper were generated using Fortran and Stata and organized into 10 numerical tables and 6 figures.

Stata Code:

- The Stata do file titled "StataFiles/replication_reduced_form.do} produces the numbers presented in Tables 1, 2, 5, 9,10, and 11. All the datasets required to run this code are in the directory "Data/Data_For_Stata_Files".
- The Stata do file "StataFiles/Selection_Analysis.do" generates the numbers in Panel B of Table 4 and the numbers reported in Tables 6 and 7. All the datasets required to run this code are in the directory "Data/Data_For_Stata_Files".

Fortran Code:

- Before compiling the code, one must replace the directory path for the different datasets used in the code from:
  /DIRECTORY_WHERE_DATA_ARE_SAVED/
  to the path to where the datasets have been saved. This change must be made in *main.f90, simulatemun.f90, read_ini_data.f90,* and in *standarderrors_SMM.f90*.
- The code can then be compiled using the following commands:
  - *make clean; make module; make mayor*
  - This creates the executable file *mayor.exe*, which can be used to run the code.
- If the code is compiled and run without making changes, it uses the parameters estimated in the paper and reported in Table 5. After the first iteration it produces the simulated and data moments reported in Panel A of Table 4.
- To create the moments reported in Panel B of Table 4 and the numbers reported in Tables 6 and 7, one has to create datasets of simulated data under different scenarios, by changing *flag_simulate_data* from 0 to 1 in commonvars.f90.
- The following simulated datasets are generated:
  - simdata_estimation.dat
  - simdata_base.dat
  - simdata_1term.dat
  - simdata_no_sel_sav.dat
  - simdata_no_sel_obs_unobs.dat
  - simdata_terms.dat
  - simdata_norun.dat

- As mentioned above, these datasets are used in the STATA file Selection_Analysis.do to generate the numbers in Panel B of Table 4 and the numbers reported in Tables 6 and 7.
- To compute the standard errors, *flag_compstderrs* must be changed from 0 to 1 in commonvars.f90.
- To create Figure 1, set *flag_simulate_data=0*, *flag_compstderrs=0, flag_policy_evaluation=1,* and *flag_optimal_auditprob=1* in commonvars.f90. The output file produces the optimal audit policy for different policy and policy bundles. Look for the output:

HIGH WTP Audit policy 1 0.0300000000 -0.2500000000 1.0000000000 -1.0456046829 -1.0917821095 -0.0547549986 0.1129039496 0.1065281933 0.1229884772 0.0000000000
HIGH WTP Audit policy 2 0.0400000000 -0.1300000000 1.0000000000 -0.4242502578 -0.4429865789 -0.0222166395 0.1074947647 0.0995146620 0.1201219630 0.0000000000
HIGH WTP Audit policy 3 0.0500000000 0.0000000000 1.0000000000 0.0000000000 0.0000000000 0.0000000000 0.1029582106 0.0939638459 0.1171907357 0.0000000000
HIGH WTP Audit policy 4 0.0600000000 0.1200000000 1.0000000000 2.7408240675 2.8618680950 0.1435282572 0.0989573476 0.0892424226 0.1143265256 0.0000000000
HIGH WTP Audit policy 5 0.0700000000 0.2500000000 1.0000000000 5.4720926160 5.7137586672 0.2865561222 0.0951650783 0.0849103220 0.1113873120 0.0000000000
HIGH WTP Audit policy 6 0.0800000000 0.3800000000 1.0000000000 7.3372823447 7.6613214601 0.3842301883 0.0914450600 0.0806636318 0.1085022266 0.0000000000
HIGH WTP Audit policy 7 0.0900000000 0.5000000000 1.0000000000 8.4867506436 8.8615541528 0.4444241947 0.0879003573 0.0768778776 0.1053336939 0.0000000000
HIGH WTP Audit policy 8 0.1000000000 0.6300000000 1.0000000000 9.2563835545 9.6651766468 0.4847274275 0.0845746929 0.0734351429 0.1021846635 0.0000000000
HIGH WTP Audit policy 9 0.1100000000 0.7500000000 1.0000000000 10.0687287945 10.5133977902 0.5272673694 0.0815236926 0.0703663501 0.0991557497 0.0000000000
HIGH WTP Audit policy 10 0.1200000000 0.8800000000 1.0000000000 10.5737990694 11.0407736705 0.5537162966 0.0785813330 0.0674707835 0.0961289871 0.0000000000
HIGH WTP Audit policy 11 0.1300000000 1.0000000000 1.0000000000 11.0529520894 11.5410877026 0.5788080195 0.0758118365 0.0648690751 0.0930876733 0.0000000000
HIGH WTP Audit policy 12 0.1400000000 1.1300000000 1.0000000000 11.3993465393 11.9027800988 0.5969475974 0.0731232832 0.0623489688 0.0901235643 0.0000000000
HIGH WTP Audit policy 13 0.1500000000 1.2600000000 1.0000000000 11.4286425020 11.9333698700 0.5984817340 0.0705622720 0.0599753132 0.0872552502 0.0000000000
Audit policy 14 0.1600000000 1.3800000000 1.0000000000 11.3159918510 11.8157441866 0.5925825769 0.0680876523 0.0576899244 0.0844678707 0.0000000000
Audit policy 15 0.1700000000 1.5100000000 1.0000000000 11.0356015096 11.5229708628 0.5778994247 0.0657031443 0.0555136415 0.0817450638 0.0000000000
Audit policy 16 0.1800000000 1.6300000000 1.0000000000 10.8892568998 11.3701631819 0.5702358219 0.0634230308 0.0534374094 0.0791298234 0.0000000000
Audit policy 17 0.1900000000 1.7600000000 1.0000000000 10.4888037511 10.9520246726 0.5492653616 0.0611923543 0.0514392134 0.0765187567 0.0000000000
Audit policy 18 0.2000000000 1.8900000000 1.0000000000 10.0765916452 10.5216078909 0.5276791219 0.0590611363 0.0495141072 0.0740503780 0.0000000000

- The 3rd column lists the chosen audit probability, the 8th column the average willingness to pay, and the 9th column the average fraction stolen; the optimal audit probability is in the last row with *HIGH WTP Audit policy.*
- The output file also contains information on the optimal audit probability for all policy bundles that include an audit policy. For example, for the bundle no-run and audit policy, the output file contains the following information:

HIGH WTP No-run policy 37 0.0300000000 -0.2500000000 1.0000000000 8.8257051708 9.2154780543 0.4621741675 0.1038017625 0.0849663738 0.1340523805 0.0000000000

HIGH WTP No-run policy 38 0.0400000000 -0.1300000000 1.0000000000 15.2808099979 15.9556620646 0.8002075192 0.0951299169 0.0732752378 0.1303240056 0.0000000000
HIGH WTP No-run policy 39 0.0500000000 0.0000000000 1.0000000000 18.7127271815 19.5391442767 0.9799261293 0.0874158075 0.0635827557 0.1258578646 0.0000000000
HIGH WTP No-run policy 40 0.0600000000 0.1200000000 1.0000000000 20.6687896327 21.5815930378 1.0823589115 0.0807259540 0.0558795132 0.1208460837 0.0000000000
HIGH WTP No-run policy 41 0.0700000000 0.2500000000 1.0000000000 22.1541446639 23.1325463529 1.1601422400 0.0751474308 0.0498525405 0.1160253209 0.0000000000
HIGH WTP No-run policy 42 0.0800000000 0.3800000000 1.0000000000 22.5283400463 23.5232674644 1.1797376645 0.0707346901 0.0451279612 0.1121611588 0.0000000000
HIGH WTP No-run policy 43 0.0900000000 0.5000000000 1.0000000000 22.5442070891 23.5398352492 1.1805685712 0.0670206062 0.0412088260 0.1088254199 0.0000000000
No-run policy 44 0.1000000000 0.6300000000 1.0000000000 22.2003788004 23.1808223447 1.1625633750 0.0637681919 0.0378708569 0.1057426801 0.0000000000
No-run policy 45 0.1100000000 0.7500000000 1.0000000000 21.9894936165 22.9606237603 1.1515199873 0.0608103710 0.0349114647 0.1028078481 0.0000000000
No-run policy 46 0.1200000000 0.8800000000 1.0000000000 21.6145915123 22.5691647158 1.1318875540 0.0580823606 0.0322516246 0.0999809045 0.0000000000
No-run policy 47 0.1300000000 1.0000000000 1.0000000000 21.1335679657 22.0668975483 1.1066978776 0.0554814095 0.0297339938 0.0972660857 0.0000000000
No-run policy 48 0.1400000000 1.1300000000 1.0000000000 20.6529751685 21.5650801535 1.0815307582 0.0530665249 0.0274457454 0.0946469332 0.0000000000
No-run policy 49 0.1500000000 1.2600000000 1.0000000000 19.9057183323 20.7848219372 1.0423992894 0.0506834270 0.0251625217 0.0920701107 0.0000000000
No-run policy 50 0.1600000000 1.3800000000 1.0000000000 19.2309615051 20.0802655745 1.0070644160 0.0483639252 0.0229543119 0.0895306428 0.0000000000
No-run policy 51 0.1700000000 1.5100000000 1.0000000000 18.4654543840 19.2809510791 0.9669772378 0.0460293217 0.0207101868 0.0870101540 0.0000000000
No-run policy 52 0.1800000000 1.6300000000 1.0000000000 17.7956725160 18.5815893866 0.9319028872 0.0437583271 0.0185922625 0.0844499520 0.0000000000
No-run policy 53 0.1900000000 1.7600000000 1.0000000000 17.0458059114 17.7986061457 0.8926347531 0.0415029873 0.0165225591 0.0818385642 0.0000000000
No-run policy 54 0.2000000000 1.8900000000 1.0000000000 16.1873496772 16.9022375911 0.8476801248 0.0393280421 0.0146020396 0.0791898230 0.0000000000

- The optimal audit policy when combined with the no-run policy is given by 9%, the last row with *HIGH WTP No-run policy*.
- To compute the policy outcomes reported in Figures 2 and 3, set *flag_policy_evaluation*=1, *flag_optimal_auditprob*=0, and *Nboot_max*=256 in commonvars.f90, and *Npolicies* = 12 in main.f90.
- The Fortran code then generates the following file:
    - simparam_base.dat
    - simparam_prau.dat
    - simparam_norun.dat
    - simparam_terms.dat
    - simparam_terms_norun.dat
    - simparam_prau_cost.dat
    - simparam_wages_cost.dat
    - simparam_optimal_prau.dat
    - simparam_term_optimal_prau.dat
    - simparam_norun_optimal_prau.dat
    - simparam_term_norun_optimal_prau.dat
    - simparam_term_norun_optimal_prau_3rd.dat
    - simparam_wage_optimal_prau.dat

- These files are used in the Stata file Conf_Interv_Policies.do to generate average stealing, average stealing in the first, second, and (if available) third term, average willingness to pay, and the corresponding confidence bands.
- To compute the policy outcomes reported in the first half of Table 12 (25% Increase in ability, set *flag_policy_evaluation*=1, *flag_optimal_auditprob*=0, *flag_increase_ab_p25*=1, and *Nboot_max*=1 in commonvars.f90, and *Npolicies* = 12 in main.f90; the end of the output file contains the results in the form:

```
policy 1    1.0000000000  19.0489223280  19.8901869339  0.9975316021  0.0779509162  0.0573088298  0.1104920110
0.0000000000
policy 2    1.0000000000  10.3119122898  10.7673210882  0.5400021172  0.0831731405  0.0856562975  0.0793581854
0.0649733513
policy 3    1.0000000000  23.2286944795  24.2545519096  1.2164130033  0.0605104105  0.0572253616  0.0656489837
0.0784727722
policy 4    1.0000000000  11.7686290985  12.2883714204  0.6162857529  0.0585087829  0.0505688566  0.0707264878
0.0000000000
policy 5    1.0000000000  13.1800261804  13.7621005539  0.6901961384  0.0782787224  0.0793897244  0.0765636572
0.0000000000
policy 6    1.0000000000  11.9002248666  12.4257789010  0.6231770056  0.0624782744  0.0543219760  0.0750446399
0.0000000000
policy 7    1.0000000000  16.6000852115  17.3332009176  0.8692937748  0.0597230982  0.0586301312  0.0613965545
0.0577321384
policy 8    1.0000000000  23.0506259137  24.0686192359  1.2070881177  0.0596728096  0.0370142777  0.0955438357
0.0000000000
policy 9    1.0000000000  25.3213196784  26.4395944895  1.3259971431  0.0397092897  0.0371090255  0.0437919974
0.0775390415
policy 10   1.0000000000  24.7752574179  25.8694162794  1.2974015957  0.0606608354  0.0571928060  0.0660853906
0.0000000000
policy 11   1.0000000000  16.7867771500  17.5281378013  0.8790702390  0.0651602927  0.0634527622  0.0677883112
0.0000000000
policy 12   1.0000000000  0.0000000000  0.0000000000  0.0000000000  0.0917249754  0.0859318892  0.1006876569
0.0000000000
```

  - Where the policy numbers corresponds to:

```
. ************************************************************************
. * POLICY = 1  ====>  NO RUN                                  *
. * POLICY = 2  ====>  TERMS                                   *
. * POLICY = 3  ====>  TERMS-NO RUN                            *
. * POLICY = 4  ====>  AUDIT WITH COST INCLUDED                *
. * POLICY = 5  ====>  WAGES WITH COST INCLUDED                *
. * POLICY = 6  ====>  OPTIMAL AUDIT PROB                      *
. * POLICY = 7  ====>  TERM WITH OPTIMAL AUDIT PROB            *
. * POLICY = 8  ====>  NO-RUN WITH OPTIMAL AUDIT PROB          *
. * POLICY = 9  ====>  TERM AND NO-RUN WITH OPTIMAL AUDIT PROB *
. * POLICY = 10  ====>  TERM AND NO-RUN WITH OPTIMAL AUDIT PROB ONLY 3RD TERM *
. * POLICY = 11 ====>  WAGES WITH OPTIMAL AUDIT PROB           *
. * POLICY = 12 ====>  BASE                                    *
. ************************************************************************
```

- And the columns of interest are: 6th willingness to pay; 7th-10th average fraction stolen, average fraction stolen 1st, 2nd, and 3rd term.
- To compute the second half of Table 12 (25% Decrease in ability, set *flag_policy_evaluation*=1, *flag_optimal_auditprob*=0, *flag_increase_ab_m25*=1, *Nboot_max*=1, and *Npolicies* = 12 in main.f90 in commonvars.f90.
- To create Figure 4, set *flag_policy_evaluation=1* and *flag_different_fines*=1 in commonvars.f90, and *Npolicies* = *n_chfine* in main.f90; the end of the output file contains the results in the form:

-

policy 1 -0.5000000000 -1.0422782560 1.0000000000 -1.4726178756 -1.5376536438 -0.0771163241 0.1160078858 0.1106400705 0.1245020756 0.0000000000
policy 2 0.0000000000 -0.6948521706 1.0000000000 0.0000000000 0.0000000000 0.0000000000 0.1029582106 0.0939638459 0.1171907357 0.0000000000
policy 3 0.5000000000 -0.3474260853 1.0000000000 8.9133966141 9.3070422472 0.4667662901 0.0860107601 0.0763536366 0.1012886089 0.0000000000
policy 4 1.0000000000 0.0000000000 1.0000000000 16.7186812676 17.4570345752 0.8755042738 0.0674759687 0.0585151585 0.0816430475 0.0000000000
policy 5 1.5000000000 0.3474260853 1.0000000000 22.8328416021 23.8412168351 1.1956834445 0.0501259395 0.0429158843 0.0615166668 0.0000000000
policy 6 2.0000000000 0.6948521706 1.0000000000 27.2510790546 28.4545785432 1.4270525167 0.0356141558 0.0297584246 0.0448596918 0.0000000000
policy 7 2.5000000000 1.0422782560 1.0000000000 30.6245893291 31.9770744003 1.6037125424 0.0243113520 0.0197370788 0.0315291499 0.0000000000
policy 8 3.0000000000 1.3897043413 1.0000000000 33.0421735631 34.5014273014 1.7303137555 0.0154070658 0.0120494898 0.0207017908 0.0000000000
policy 9 3.5000000000 1.7371304266 1.0000000000 35.1879659695 36.7419851320 1.8426820932 0.0090803367 0.0068738117 0.0125572473 0.0000000000
policy 10 4.0000000000 2.0845565119 1.0000000000 37.0667809269 38.7037748896 1.9410696692 0.0048691347 0.0036880798 0.0067279978 0.0000000000
policy 11 4.5000000000 2.4319825972 1.0000000000 38.1920924711 39.8787839839 1.9999986631 0.0022275705 0.0017067340 0.0030458473 0.0000000000
policy 12 5.0000000000 2.7794086825 1.0000000000 45.1305331316 47.1236495669 2.3633427783 0.0006901375 0.0005485643 0.0009120783 0.0000000000
policy 13 5.5000000000 3.1268347679 1.0000000000 48.1983530595 50.3269547616 2.5239947708 0.0000204342 0.0000200951 0.0000209639 0.0000000000
policy 14 6.0000000000 3.4742608532 1.0000000000 48.5020393936 50.6440529076 2.5398978603 0.0000000000 0.0000000000 0.0000000000 0.0000000000
policy 15 6.5000000000 3.8216869385 1.0000000000 48.5020393936 50.6440529076 2.5398978603 0.0000000000 0.0000000000 0.0000000000 0.0000000000
policy 16 7.0000000000 4.1691130238 1.0000000000 48.5020393936 50.6440529076 2.5398978603 0.0000000000 0.0000000000 0.0000000000 0.0000000000
policy 17 7.5000000000 4.5165391091 1.0000000000 48.5020393936 50.6440529076 2.5398978603 0.0000000000 0.0000000000 0.0000000000 0.0000000000
policy 18 8.0000000000 4.8639651944 1.0000000000 48.5020393936 50.6440529076 2.5398978603 0.0000000000 0.0000000000 0.0000000000 0.0000000000
policy 19 8.5000000000 5.2113912798 1.0000000000 48.5020393936 50.6440529076 2.5398978603 0.0000000000 0.0000000000 0.0000000000 0.0000000000
policy 20 9.0000000000 5.5588173651 1.0000000000 48.5020393936 50.6440529076 2.5398978603 0.0000000000 0.0000000000 0.0000000000 0.0000000000

- Where the multiple of the mean of the fine is given by the EXPONENTIAL of the 4th column (for example, policy 12 corresponds to EXP(2.7794086825) = 16.1, i.e. the mean fine is 16 times larger than the one used in the estimation; columns 9th, 10th, 11th, and 12th report average fraction stolen, and average fraction stolen in 1st, 2nd, and 3rd term.
- To create Figure 5, set *flag_policy_evaluation=1* and *flag_different_conv_prob*=1 in commonvars.f90, and *Npolicies = n_prconv* in main.f90; the end of the output file contains the results in the form:

policy 1 0.5000000000 1.0000000000 -0.8093809784 -0.8451259701 -0.0423847129 0.1107534557 0.1027561627 0.1234050276 0.0000000000
policy 2 0.7600000000 1.0000000000 0.0000000000 0.0000000000 0.0000000000 0.1029582106 0.0939638459 0.1171907357 0.0000000000
policy 3 1.0000000000 1.0000000000 5.4940316460 5.7366665987 0.2877049996 0.0971426735 0.0878921786 0.1117844200 0.0000000000

- Where columns 8th, 9th, 10th, and 11th report the average fraction stolen, and the average fraction stolen in the 1st, 2nd, and 3rd term (column 11th equals always zero because we do not consider a policy with a 3rd term).
- To create Figure 6, set *flag_policy_evaluation=1* in commonvars.f90, and *flag_no_change_ability*=1 and *Npolicies = 12* in main.f90; the end of the output file contains the results in the form:

policy 1 1.0000000000 11.4505903355 11.9562869938 0.5996310723 0.0884136353 0.0635827557 0.1284651611 0.0000000000
policy 2 1.0000000000 3.9314099445 4.1050342567 0.2058754607 0.0942688914 0.0936294215 0.0952731850 0.0878139055
policy 3 1.0000000000 13.6275230638 14.2293604078 0.7136301299 0.0676107612 0.0633845776 0.0743733813 0.0998191634
policy 4 1.0000000000 6.1485871327 6.4201294615 0.3219819929 0.0674570067 0.0559535401 0.0855713481 0.0000000000
policy 5 1.0000000000 6.4427915333 6.7273269199 0.3373885435 0.0923998424 0.0881636621 0.0990883409 0.0000000000
policy 6 1.0000000000 6.3108828448 6.5895926992 0.3304809042 0.0718309893 0.0599753132 0.0905244164 0.0000000000
policy 7 1.0000000000 8.9525832890 9.3479595377 0.4688183718 0.0678577009 0.0645852008 0.0729845248 0.0745008353
policy 8 1.0000000000 14.1813763204 14.8076736906 0.7426336670 0.0681505477 0.0412088260 0.1117854170 0.0000000000
policy 9 1.0000000000 15.5836091245 16.2718338210 0.8160641483 0.0453590565 0.0413004375 0.0518795059 0.0944678336
policy 10 1.0000000000 14.3281372423 14.9609160694 0.7503190707 0.0680880923 0.0633647929 0.0756450543 0.0000000000
policy 11 1.0000000000 9.2339164991 9.6417173705 0.4835508991 0.0768550935 0.0705133891 0.0868418774 0.0000000000
policy 12 1.0000000000 0.0000000000 0.0000000000 0.0000000000 0.1029582106 0.0939638459 0.1171907357 0.0000000000

- Where the 6th column reports the average willingness to pay, and columns 7th, 8th, 9th, and 10th report the average fraction stolen, and the average fraction stolen in the 1st, 2nd, and 3rd term for the 12 policies considered in the paper.