Software and operating system used

Mathematica 11.3, Microsoft Excel 2016, Windows 10

Step 1 for parametrization of benchmark model

1. Calibration in Microsoft Excel 2016

A. Data: Excel file; Brain drain data_JIE revised, sheet; beta_0.7

B. The workfile mentioned above contains the data and calibrations to parametrize the benchmark model and obtain results given in table 1 of the study. The data sources are mentioned both in the article as well as in excel file. Clicking on the cells shows the equations used for calibration.

Step 2 welfare analysis on page 18-21

2. Once the model is parametrized the results of counterfactual analysis on page 18-21 are obtained setting p (brain drain)=0 and using the parameters obtained in step 1. Running Mathematica file *"Calibration_Beta=0.7_p_0_i.nb"* yields the results for the hypothetical economy with no brain drain. [1] The results from this file are transferred to excel file *"Results"* on worksheet *"RobustData"* for further analysis. These results are used for graphs in figure 2 (the graphs are also given on sheet *"RobustGraph"* of the excel file *"Results"*). The graphs are converted into pdf and used in figure 2. For figure 3 the results for marginal productivities and market tightness obtained in step 1 and step 2 are used.

Step 3 sensitivity analysis on page 21-24

3. For cross-country disparities step 1 and step 2 are repeated keeping sets of country specific parameters at median one at a time (see section "*dissecting cross-country disparities"* for sets of parameters). The results are used for figure 4. The following ".nb" files are run in the given order for the sensitivity analysis

i. Calibration_Beta=0.7_all_med_p_i.nb

ii. Calibration_Beta=0.7_all_med_p_0_i.nb

iii. Calibration_Beta=0.7_rho_G_med_p_i.nb

iv. Calibration_Beta=0.7_rho_G_med_p_0_i.nb

v. Calibration_Beta=0.7_mu_S_med_p_i.nb

vi. Calibration_Beta=0.7_mu_S_med_p_0_i.nb

vii. Calibration_Beta=0.7_AFAI_med_p_i.nb

viii. Calibration_Beta=0.7_AFAI_med_p_0_i.nb

The results from these simulations are transferred to the excel file *"Results"* on sheet *"Shapley"*. These are used for figure 4 and table 2. The graphs in figure 4 are given on the sheet "*Shapley*". The results reported in table A4 in appendix B are also calculated on this sheet.

Step 4 additional mechanisms on page 24-29

4. Excel file "*sheets for externalities*" contain the calculations of the parameters required for the simulation results reported in section 3 and figure 5.

A. For figure 5a and 5b the parameters are calculated on sheet "*Pessimist_Schooling ext_esp0.04*". Using these parameters, running the "*Calibration_Beta=0.7_p_0_i_AF_pes_eps0.04.nb*" the first

[1] In all .nb files the required data is imported from relevant excel files. The second cell in all .nb files shows the file path for author's pc. For the purposes of replication please modify the file path.

scenario with schooling externality is simulated. The results are transferred to excel file "*Results*" on sheet "*VariantData*" and the graphs are on sheet "*VariantGraph*".

B. For figure 5c and 5d the parameters are calculated on sheet "*Pessimist_Sch ext_esp0.04_AFAI*". Using these parameters, running the "*Calibration_Beta=0.7_p_0_i_AFAI_pes_eps0.04.nb*" the next scenario with schooling externality is simulated. The results are transferred to excel file "*Results*" on sheet "*VariantData*" and the graphs are on sheet "*VariantGraph*".

C. For figure 5e and 5f the parameters are calculated on sheet "*Pessimist_Scho ext_esp0.1*". Using these parameters, running the "*Calibration_Beta=0.7_p_0_i_AF_pes_eps0.1.nb*" the third scenario with schooling externality is simulated. The results are transferred to excel file "*Results*" on sheet "*VariantData*" and the graphs are on sheet "*VariantGraph*".

D. For figure 5g and 5h the parameters are calculated on sheet "*Pessimist_Sch ext_esp0.1_AFAI*". Using these parameters, running the "*Calibration_Beta=0.7_p_0_i_AFAI_pes_eps0.1.nb*" the fourth scenario with schooling externality is simulated. The results are transferred to excel file "*Results*" on sheet "*VariantData*" and the graphs are on sheet "*VariantGraph*".

E. For figure 5i and 5j the parameters are calculated on sheet "*Diasp_AFAI*". Using these parameters, running the "*Calibration_Beta=0.7_p_0_AFAI_opt.nb*" the scenario with diaspora externality is simulated. The results are transferred to excel file "*Results*" on sheet "*VariantData*" and the graphs are on sheet "*VariantGraph*".

F. For fotenote 12, the excel sheets "*Pessimist_Schooling extr*" and "*Pessimist_schooling in AF,AI*" and the following .nb files are used in the given order

i. Calibration_Beta=0.7_p_0_AF_pessi

ii. Calibration_Beta=0.7_p_0_AFAI_pessi

G. For extension with endogenous social mobility (figure 6) using the benchmark parameters the following .nb file are run in the given order

i. endo_rho_base_with_gamma_9.nb

ii. endo_rho_base_with_gamma_9_p_divided_2.nb

iii. endo_rho_base_with_gamma_9_p_0.nb

The results are then transferred to excel file "*Results*" on sheet "*RobustData*" for further analysis and the graphs for figure 6 are on sheet "*RobustGraph*".

Step 5 Robustness analysis

5. The data on excel file "*Brain drain data_JIE revised*" with following sheets and .nb files are used for the robustness checks in appendix C.

A. Robustness to parameter values

i. "*beta_0,5.xlsx*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.5_p_0_i.nb*" for counterfactual scenario (figures A1a, A1b)
ii. "*beta_0,7_iH0,25.xlsx*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.7_iH_0.25IL_p_0_i.nb*" for counterfactual scenario (figures A1c, A1d)
iii. "*beta0.7_JD(delta)_0.04_Hskilled.xlsx*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.7_p_0_i_JD_HS_0.04.nb*" for counterfactual scenario (figures A1e, A1f)
iv. "*beta0.7_JD(delta)_0.08_LSkilled.xlsx*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.7_p_0_i_JD_LS_0.08.nb*" for counterfactual scenario (figures A1g, A1h)

v. "*Calibration_Beta=0.7_k_var_p_i.nb*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.7_k_var_p_0_i.nb*" for counterfactual scenario (figures A1i, A1j)

B. Robustness to technological environment

i. "*w_I_H, AI skill premium observe.xlsx*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.7_p_0_i_Skill prem.nb*" for counterfactual scenario (figures A2a, A2b)

ii. "*CES in Informality.sigma_4.xlsx*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.7_p_0_i_CES_4.nb*" for counterfactual scenario (figures A2c, A2d)

iii. "*CES in Informality.sigma_2.xlsx*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.7_p_0_i_CES_2.nb*" for counterfactual scenario (figures A2e, A2f)

iv. "*beta_0.7_sigma_3_formal.xlsx*" for calibration of parameters at observed brain drain and "*Calibration_Beta=0.7_p_i_0_sigma=3_formal.nb*" for counterfactual scenario (figures A2g, A2h)

All the results are transferred to excel file "*Results*" on sheet "*RobustData*" and the graphs are on sheet "*RobustGraph*".

Step 6 Appendix A and B

6. the results reported in tables A1, A2 and A3 are calculated in excel file "*Results*" on sheet "*Appendix*". The results reported in table A4 are calculated on sheet "*Shapley*".