Instructions for reproducing the results reported in “Creating a GTAP baseline for 2014 to 2050 using shock-intensive simulations”

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Main simulation GTAP19A71-C72B-R01R-P01P.ZIP

Static simulation: used in Part 3 GTAP19A71-C73B-R01R-P01P.ZIP

of the supplementary material

The results in the main paper can all be deduced by running the main simulation stored in GTAP19A71-C72B-R01R-P01P.ZIP. This zip needs to be unzipped in Rundynam software. This is GEMPACK software produced at the Centre of Policy Studies. Details for obtaining Rundynam are at <https://www.copsmodels.com/gprdyn.htm>.

When the main simulation zip file is unzipped in Rundynam the baseline needs to be run. The baseline consists of 5 periods: 2014-19, 2019-30, 2030-40 2040-50 and (2015-60). In the paper we present results for the first 4 periods up to 2050. [We omit the 2050-60 simulation.]

Tables of simulation results in section 5

All the Tables in section 5 are derived from the results for the 2014-19 baseline in the main simulation.

**Table 3** presents results for 2014-19 for Real GDP (*qgdp* in GTAP notation), Capital (*kb*), Employment (*lsreg*), Natural resource use [*qo(NatRes)*, Technology contribution to GDP (*cont\_tech*), Real wage rate (*realwager*) and Rate of return on capital (*rorc*).

**Table 4** presents results for 2014-19 for Real GDP (*qgdp*), Real private consumption (*cr*), Real government consumption (*gr*), Real investment (*qcgds*), Export volumes (*expvol*), Import volumes (*impvol*), Private consumption propensity (*apcnnp*), Public consumption propensity (*dpgov*), Investment propensity (*f\_ke*) and Preference twist towards imports (*twist\_src\_i*).

**Table 5** presents results for 2014-19 for world energy variables coal, oil and gas: Quantity of world output (*qworld*), Average world price (*pworld*) and Shifts in world demand (*wldout\_sh*).

**Table 6** presents results for 2014-19 for Price index for GDP (*pgdp\_obs*), Price index for exports (*p\_x\_obs*), Export volumes (*expvol*), Phantom tax on exports from regions (*phtx\_i*) and Preference shifts towards a region’s exports (*f3\_twistmd*).

**Table 7** presents results for 2014-19 for Price index for imports (*p\_m\_obs*) and Discriminatory phantom tax on exports *to* regions (*phtx\_i2*).

**Table 8** presents results for 2014-19 for Price index for GDP (*pgdp\_obs*), Price of investment (*p\_i\_obs*) and Productivity of capital goods (*a\_cgds*).

**Table 9** was created using 2014 data items and variables for 2014-19. The data items for 2014 are in columns (1) and (2) of the table below. The variables are in columns (3) and (4). Columns (5) to (7) show the results in Table 9. Row 3 from the table shows how the results in columns (5) to (7) were created from the data and simulation variables.

The change in real wealth is changes in accumulated savings plus other factors.

Table showing data and variables used in creating Table 9

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | RealWealth  2014 | GDP 2014 | % ch real wealth 2014-19 | Contributions of other effects on wealth between 2014 & 2019 | Change in real wealth between 2014 & 2019 | Real accumulated saving: 2014, 2015, 2016, 2017 & 2018 | Contributions of other effects on wealth between 2014 & 2019 |
|  | (WQHHLD) | (GDPIN) | (rwealth) | (d\_swqh\_b) |  |  |  |
|  | (1) | (2) | (3) | (4) | (5)=(1)\*(3)/(2) | (6)=(5)-(7) | (7) = 100\*(4)/(2) |
|  |  |  |  |  | Percent of 2014 GDP | | |
| 1 USA | 36191876 | 17351028 | 6.9444 | -609165 | 14.49 | 18.00 | -3.51 |
| 2 Canada | 4899983 | 1806968 | 23.7773 | 43698 | 64.48 | 62.06 | 2.42 |
| 3 Mexico | 4994308 | 1311140 | 16.9358 | 838441 | 64.51 | 0.56 | 63.95 |
| 4 China | 37942864 | 10088053 | 58.5599 | 2784618 | 220.25 | 192.65 | 27.60 |
| 5 Japan | 18526076 | 4617154 | 8.2707 | -1661654 | 33.19 | 69.17 | -35.99 |
| 6 SKorea | 4825363 | 1373417 | 35.8061 | 411739 | 125.80 | 95.82 | 29.98 |
| 7 India | 6885754 | 2102008 | 42.9229 | 1377254 | 140.61 | 75.09 | 65.52 |
| 8 France | 7838979 | 2840710 | 10.7915 | -124218 | 29.78 | 34.15 | -4.37 |
| 9 Germany | 14408984 | 3883100 | 19.1700 | -31414 | 71.13 | 71.94 | -0.81 |
| 10 UK | 8769711 | 3004112 | 17.8828 | 1496997 | 52.20 | 2.37 | 49.83 |
| 11 RoEU | 31538972 | 8867711 | 16.4097 | 2159729 | 58.36 | 34.01 | 24.35 |
| 12 SaudiAr | 3125447 | 746666.6 | 27.5963 | -358349 | 115.51 | 163.51 | -47.99 |
| 13 RoW | 69288592 | 20089670 | 18.7043 | 0 | 64.51 | 64.51 | 0.00 |

Tables of simulation results in section 6

Tables (10) to (12) show percentage changes in macro variables for each of the 13 countries for each of the time periods 2014-19, 2019-30, 2030-40 and 2040-50. To make the numbers directly comparable for periods of different length they are presented in average-annual format. For example, Table 4 shows that the percentage change in real GDP in the USA between 2014 and 2019 was 12.58. In average-annual terms this is: where 5 is the length of the period 2014-19.

**Table 10** presents average annual results for each of the 4 simulation periods for Real GDP (*qgdp*), Capital (*kb*), Employment (*lsreg*), Population (*pop*). Technology contribution to GDP (*cont\_tech*), Real wage rate (*realwager*) and Rate of return on capital (*rorc*).

**Table 11** presents average annual results for each of the 4 simulation periods for Real GDP (*qgdp*), Real private consumption (*cr*), Real government consumption (*gr*), Real investment (*qcgds*), Export volumes (*expvol*), Import volumes (*impvol*).

**Table 12** presents average annual results for each of the 4 simulation periods for Terms of trade (*tot*).

**Table 13** presents data (coefficients) and simulation results (variables) s. The country rows of the first 4 columns are the post sim values for the ratios of private plus government consumption to income (*RAT\_CY*). These are the values of *RAT\_CY* in 2919, 2030, 2040 and 2050.

|  |  |  |
| --- | --- | --- |
|  |  | (A.1) |

The “world average” row of the first 4 columns are the post sim values for the ratios of private plus government consumption to income at the world level (*RAT\_CYW*).

|  |  |  |
| --- | --- | --- |
|  |  | (A.2) |

The 5th, 6th and 7th columns of Table 13 are the percentage changes in the ratios of wealth to GDP (*f\_wqh*) in the periods 2019-30, 2030-40 and 2040-50.

**Table 14** presents annual % shifts in fossil-fuel inputs per unit of activity by using agents. The relevant variable for producing the results in the top part of the table is a\_int(j). The results in the able are x(j) given by

|  |  |  |
| --- | --- | --- |
|  |  | (A.3) |

where *t* is the length of the relevant period (11 for 2019-30 and 10 for 2030-40 and 2040-50).

The second last row in Table 14 shows average-annual version of world output (*qow*).

The last row is calculated from the results for world price (pw) and the world price of gdp (*pgdpg*).

Forward looking expectations

The main simulation incorporates forward-looking expectations for 2030, 2040 and a terminal condition in 2050. This is explained in part 3 of the supplementary material. Forward-looking expectations and the terminal condition are implemented by an iterative procedure starting from a simulation with static expectations.

Tables A.21-A.23 show results for the static simulation (q=1) and for the final converged simulation (q = 8). The results for the static simulation were generated in GTAP19A71-C73B-R01R-P01P.ZIP with a standard GTAP investment specification (equalization of expected rates of return across regions under static expectations).

In the iterative procedure, we insert guesses at each step of capital growth rates in future periods [see equations (A.10) to (A.17) in the supplementary material]. The 4-period simulation at each iterative step prepares the guesses for the next iteration. These are the values generated for the 4 periods of the coefficient *GUESS*. Convergence has been achieved when the values for *GUESS* generated in iteration q are the same as the values for the variable *kbguess* used as an input to iteration q. These values for *kbguess* are the *GUESS* values from iteration q-1.

To check that our final simulation is converged, you can look at the values for *GUESS* in period 4 in GTAP19A71-C72B-R01R-P01P.ZIP and the shocks for *kbguess* in that zip.

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