Technical Note: How to use the GDyn-FS model to project the long-run impact of an economic reform: the case of the Indonesian Omnibus Law

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December 2024

Reference: Gupta, Krisna, Arianto Patunru, Paul Gretton (2024), 'Projecting the long-run impact of an economic reform: the case of the Indonesian Omnibus Law', *Asian-Pacific Economic Literature*, http://doi.org/10.1111/apel.12428 .

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Contents

1 Introduction

The purpose of this note is to provide a step-by-step approach to the use of the GDyn-FS model[2] to simulate the scenarios in 'Projecting the long-run impact of an economic reform: the case of the Indonesian Omnibus Law' (Gupta et al. 2024) using the RunDynam component of GEMPACK software.

Ingredients required to complete the simulations are provided in the accompanying zip files. The ingredients include: the database and parameter files; the TABLO code file and the Stored

[1] The author wishes to thank Krisna Gupta for preparing the originating files underpinning this note and Naman Jain for testing the material. All errors and omissions remain the responsibility of the author. Comments/suggestions welcome.

[2] The GDyn-FS model adopted in this study is described in Paul Gretton (2021), 'National and Sectoral Effects of a Decline in the Desirability of Investing in Australia', *The Australian Economic Review*, Vol. 55, No. 1, March 2022. https://onlinelibrary.wiley.com/doi/abs/10.1111/1467-8462.12441.

Input file; the model executable file gdynfs.exe created using the TABmate component of GEMPACK; a mapping file to translate simulation results to EXCEL csv files; model closure files; base data files and policy shock files. The modelling files are complemented by an EXCEL spreadsheet file that shows the tables and figures included in the article and the GTAP database aggregation adopted.

The ingredients for modelling in Gupta et al. 2024 are provided in five files with each corresponding to a scenario modelled or sensitivity test:

- **APEL_Scenario1_gdynfs-BASB-BRRR-PRDP.zip**. [Domestic regulatory reform]
- **APEL_Scenario2_gdynfs-BASB-BRRR-PRDP.zip [**Domestic regulatory reform and trade liberalisation]
- **APEL_Scenario3_gdynfs-BASB-BRRR-PRDP.zip [**More restrictive trade policy]
- **APEL_Sensitivity1_gdynfs-BASB-BRRR-PRDP.zip [**Comparative dynamic analysis of scenario 2**]**
- **APEL_Senesitivity2_gdynfs-BASB-BRRR-PRDP.zip [**Extended implementation of scenario 2**]**

The focus of this note is on the central scenario, that is, scenario 2. Once implemented, scenarios 1 and 3 and sensitivity tests 1and 2 can be modelled using similar procedures.[3] Each scenario is simulated to 2050. The focus of reporting is on results over a twenty eight year period with 2022 as the first year of policy shocks.[4]

Database and software requirements

- GTAP database release 10A (or above) – required to access the database and create new study-specific data bases.
- RunDynam, Version 3.8 or above – required to undertake simulations described in this note.
- GEMPACK, Release 12.1 or above – required to recompile the executable files and adapt the model in GEMPACK.

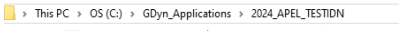
2 Getting started

To set up and run the simulations create a user project directory **GDyn_Applications\2024_APEL_TESTIDN** and save the zip file **APEL_Scenario2_gdynfs-BASB-BRRR-PRDP.zip** containing ingredients of the central

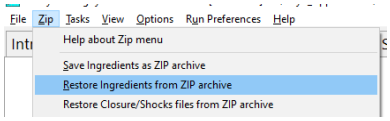
[3] It should be noted that the initial projections reported were over a 9-year period from 2022 not a 10-year period as stated in the text. This slightly affects the time path of results, but not broad conclusions reported. The simulation period has been amended in the files in this release. Corrected results are shown in the EXCEL spreadsheet of results provided with the modelling files. It should be noted that the tail of the corrected test is slightly elevated relative to the central case. This occurs because transition to a new path is not as advanced as in the central case. It does not indication that the long-run benefits are higher with extended implementation. The printed figure can be replicated by omitting the shock for the simulation year 2031.

[4] Some fractional differences may appear between printed results and simulation results in this model release due to assembly of final files for model release

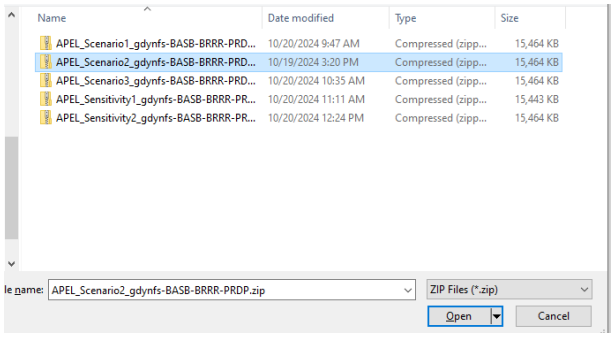
scenario to this project directory. The user project directory path referred to in this note appears as:



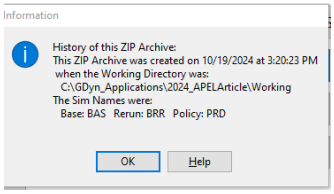
Open **RunDynam** and go to the command **Restore ingredients from zip file**:



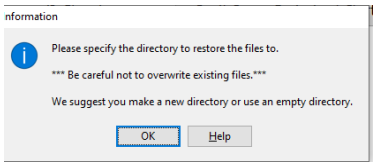
Select **APEL_Scenario2_gdynfs-BASB-BRRR-PRDP.zip** and click on **Open**:



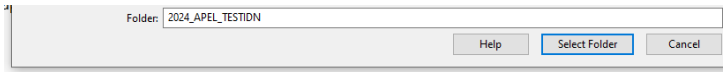
View dialogue box:



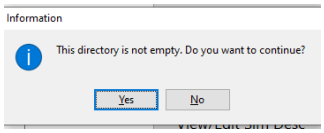
and click **OK.** View the dialogue box:



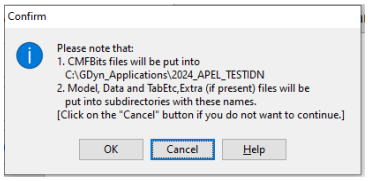
click **OK** and select folder:



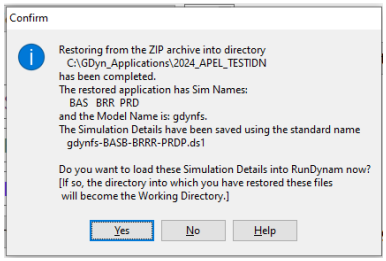
Noting that folder contains the zip file and it not empty, click **Yes** in:



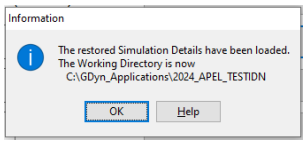
Then note unzipping protocols, confirm by clicking **OK** in:



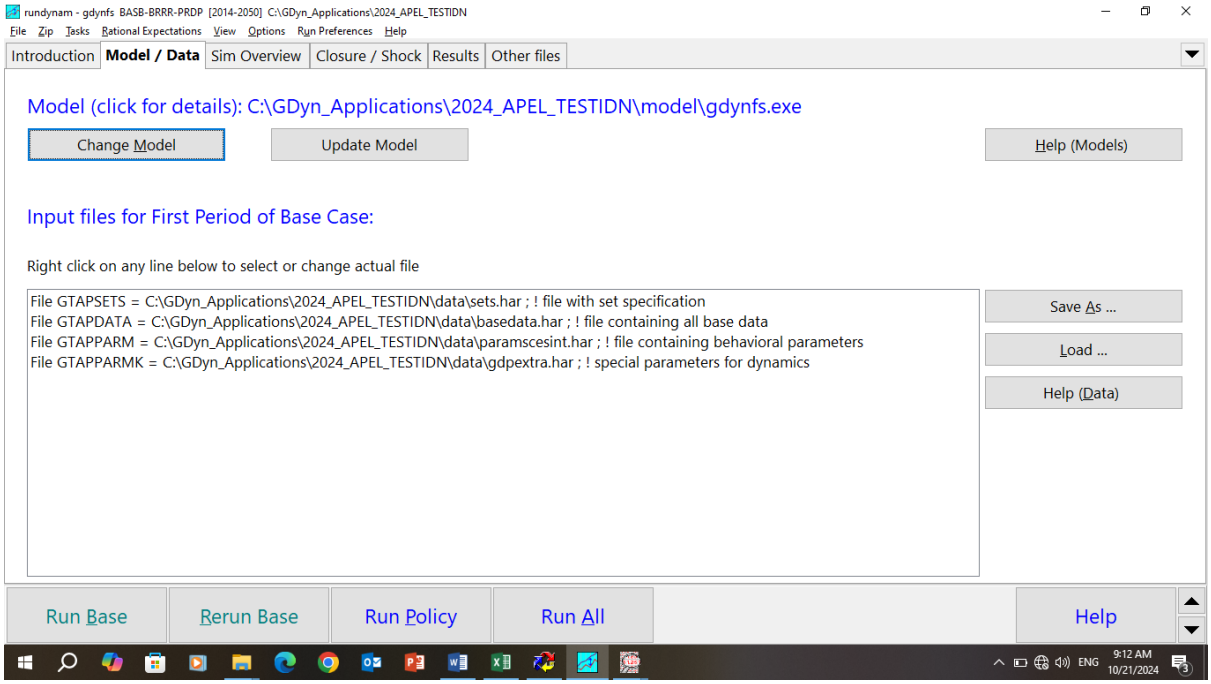
Then click **Yes** to the question 'Do you want to load simulation details into RunDynam?

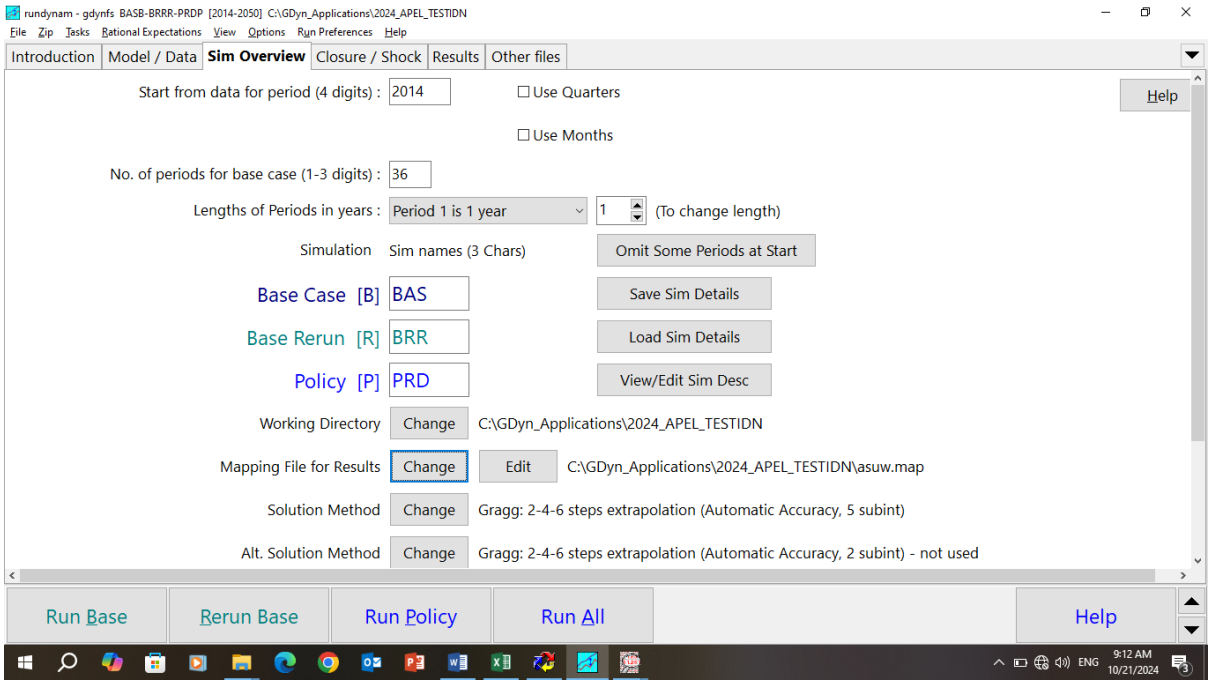


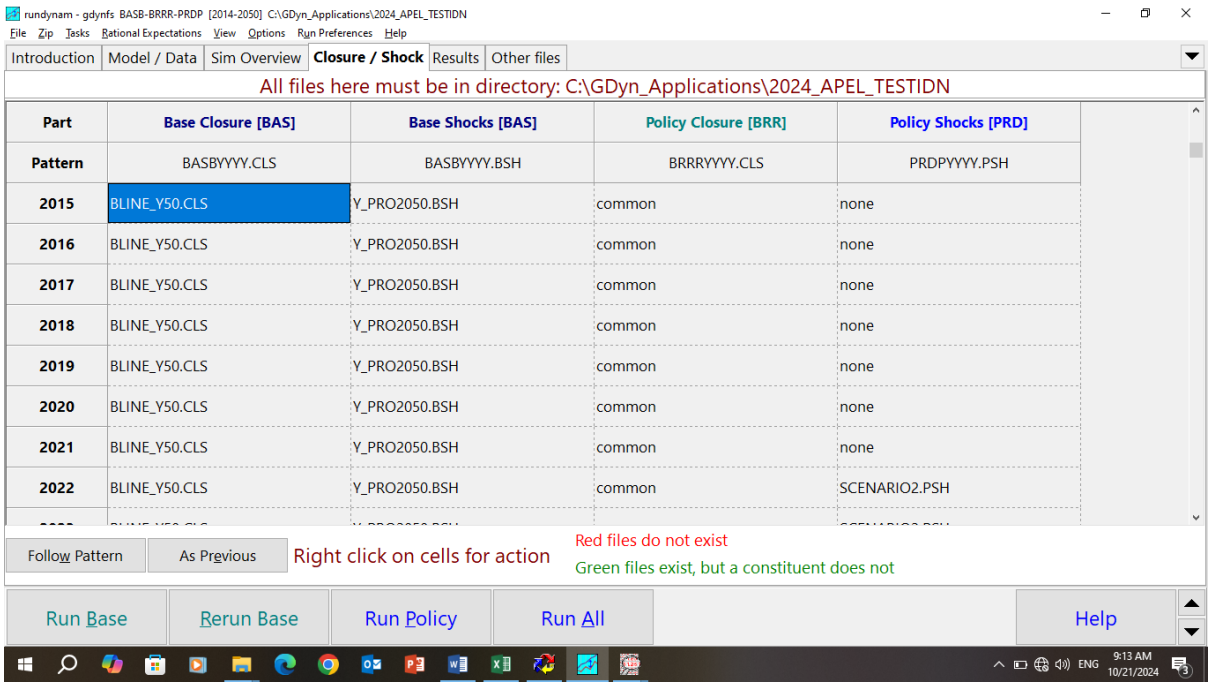
Click **OK** in the dialogue box to recognise that the simulation details are loaded and project directory is in the active working directory.



Finally, check the **Model/Data**, **Sim Overview**, and **Closure/Shock** screens of **RunDynam** for completeness. The pages should appear as follows:


rundynam - gdynfs BASB-BRRR-PRDP [2014-2050] C:\GDyn_Applications\2024_APEL_TESTIDN
File Zip Tasks Rational Expectations View Options Run Preferences Help
Introduction
Model / Data
Sim Overview
Closure / Shock
Results
Other files
Model (click for details): C:\GDyn_Applications\2024_APEL_TESTIDN\model\gdynfs.exe
Change Model
Update Model
Help (Models)
Input files for First Period of Base Case:
Right click on any line below to select or change actual file
File GTAPSETS = C:\GDyn_Applications\2024_APEL_TESTIDN\data\sets.har ; ! file with set specification
File GTAPDATA = C:\GDyn_Applications\2024_APEL_TESTIDN\data\basedata.har ; ! file containing all base data
File GTAPPARM = C:\GDyn_Applications\2024_APEL_TESTIDN\data\paramscesint.har ; ! file containing behavioral parameters
File GTAPPARMK = C:\GDyn_Applications\2024_APEL_TESTIDN\data\gdpextra.har ; ! special parameters for dynamics
Save As ...
Load ...
Help (Data)
Run Base
Rerun Base
Run Policy
Run All
Help
ENG
9:12 AM
10/21/2024


rundynam - gdynfs BASB-BRRR-PRDP [2014-2050] C:\GDyn_Applications\2024_APEL_TESTIDN
File Zip Tasks Rational Expectations View Options Run Preferences Help
Introduction
Model / Data
Sim Overview
Closure / Shock
Results
Other files
Start from data for period (4 digits) :
2014
Use Quarters
Use Months
Help
No. of periods for base case (1-3 digits) :
36
Lengths of Periods in years :
Period 1 is 1 year
1
(To change length)
Simulation
Sim names (3 Chars)
Omit Some Periods at Start
Base Case [B]
BAS
Save Sim Details
Base Rerun [R]
BRR
Load Sim Details
Policy [P]
PRD
View/Edit Sim Desc
Working Directory
Change
C:\GDyn_Applications\2024_APEL_TESTIDN
Mapping File for Results
Change
Edit
C:\GDyn_Applications\2024_APEL_TESTIDN\asuw.map
Solution Method
Change
Gragg: 2-4-6 steps extrapolation (Automatic Accuracy, 5 subint)
Alt. Solution Method
Change
Gragg: 2-4-6 steps extrapolation (Automatic Accuracy, 2 subint) - not used
Run Base
Rerun Base
Run Policy
Run All
Help
ENG
9:12 AM
10/21/2024



The files in the **Base Closure** and **Base Shocks** columns should extend to the simulation year 2050 (that is, the last year in the simulation period 2015 to 2050 for which projections are included). The policy shock file should appear in year 2022 in the **Policy Shocks** column.

If this is the case, the model is ready for simulation. If it is not the case, it will be necessary to retrace the above procedures to complete a working model.

Save simulation details

The simulation is given default label **gdynfs-BASB-BRRR-PRDP.ds1** which can be viewed by selecting **Load Sim Details** on the **RunDynam_Sim Overview** page. It is recommended that simulation details be re-saved with a simulation-specific label. To do this go to the **Sim Overview** page, select **Save Sim Details**, edit the generic label to **APEL_Scenario2_gdynfs-BASB-BRRR-PRDP.ds1** and **Save.** Confirm the process by going to **Load Sim Details**, selecting the file just saved and checking all ingredients.

Completing this step is particularly advisable if you are intending to go on to undertake the other scenarios and sensitivity tests outlined below or develop a new scenario(s) using the model.

3 Run simulation

Select **Run All** to **Run Base**, **Rerun Base** and **Run Policy** simulations (or select one at a time). Note the simulations are set to run for 36 years (see **Sim Overview)**. This comprises the period to 2050. As an indication of required run time, the full simulation using a DELL Latitude E7450 Core i5-5200U processor with 4GB-1600MHz internal memory takes about the simulation takes about 30 minutes. (Note: because of differences between solution algorithms and

computers, results may differ fractionally between simulations undertaken in different computer environments).

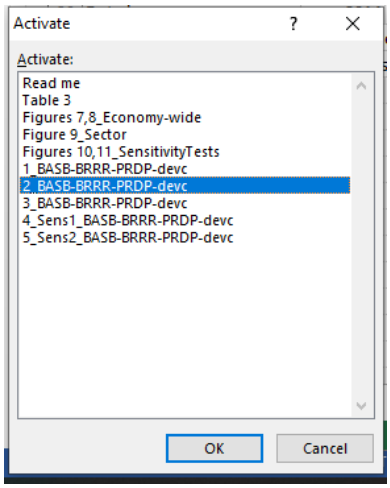
To retain results from a simulation for later reference, you need to save in the 'extras' subdirectory the simulation-specific file:

- **BASB-BRRR-PRDP-devc.csv** with a simulation-specific name such as **Scenario2_BASB-BRRR-PRDP-devc.xlsx** (plus other spreadsheet or HAR files of interest.

Tables and figures in spreadsheet format

Data for each table and figure presented in Gupta et al. (2024) is included in the EXCEL workbook **APEL2023_IDNOmnibusLaw_ModelRelease.xlsx**.

This workbook is located in the subdirectory **…\extras**. Data in each table and figure is linked to the output of the policy simulation. The workbook contains one contents page (**Read me**), four sheets showing output tables and figures (**Table 3, Figures 7,8_Economy-wide, Figure 9_Sector, Figures 10,11_SensitivityTests**) and five sheets containing detailed model results (**1_BASB-BRRR-PRDP-devc**, **2_BASB-BRRR-PRDP-devc**, **3_BASB-BRRR-PRDP-devc, 4_Sens1_BASB-BRRR-PRDP-devc, 5_Sens2_BASB-BRRR-PRDP-devc**). The second set of results relates to the central case reported in Gupta et al. (2024) while the first, third, fourth and fifth relate to the other scenarios and sensitivity tests reported (see below). To see the list of all spreadsheets in the workbook, right click on the left end of the horizontal scroll bar. This will show:



The projections reported in the workbook files #**_BASB-BRRR-PRDP-devc** refer to the differences in *variables* (**Policy v Rerun**) and are sourced to the respective simulation output file **BASB-BRRR-PRDP-devc.csv** written to the working directory in post simulation processing. For example, 2**_BASB-BRRR-PRDP-devc** (highlighted), contains the results for the central simulation. The variables included in this output file are specified in the input file **asuw.map** (see **Sim Overview** page of the **RunDynam** interface).

4 Additional simulations

As noted, four other simulations were conducted to assess impacts of alternative scenarios and the sensitivity of results to alternative modelling assumptions. The simulations may be completed following the above procedures, but beginning with the relevant zip file, that is, either:

- **APEL_Scenario1_gdynfs-BASB-BRRR-PRDP.zip** for scenario 1;
- **APEL_Scenario3_gdynfs-BASB-BRRR-PRDP.zip** for scenario 3;
- **APEL_Sensitivity1_gdynfs-BASB-BRRR-PRDP.zip** for the comparative dynamic case; and
- **APEL_Sensitivity2_gdynfs-BASB-BRRR-PRDP.zip** for the extended implementation case.

Following the above procedures, these files would be saved to a simulation-specific project directory such as **2024_APEL_TESTIDN_1** and **2024_APEL_TESTIDN_3** and so on.[5]

As for the central-case scenario, save to the 'extras' (or other nominated) subdirectory the simulation-specific file **BASB-BRRR-PRDP-devc.csv** with a simulation-specific name such as **Scenario1_BASB-BRRR-PRDP-devc.xlsx** (plus other files of interest).

6 Project sub-directory structure and file location

The above procedures adopt the default sub-directory structure provided by the **RunDynam ZIP-RESTORE** utility. They do not necessarily reflect the original subdirectory structure or a structure that may be desired by the user. Recognizing that a more nuanced sub-directory structure than the default may be preferred, this section provides one possibility cross-referenced to the default sub-directories.

Special attention to the location of the executable, TABLO (***.tab**) and stored input (***.sti**) files is warranted. In the default restore procedure, the executable image and related model files are restored to the \model subdirectory while the **tab** and **sti** files are restored to the …\tabetc subdirectory. To re-create the executable image from the model theory contained in the **tab** file according to the process defined in the **sti** file, it is necessary to re-locate the **tab** and **sti** files (that is, **gdynfs.tab** and **gdynfs.sti**) to the …\model subdirectory.[6]

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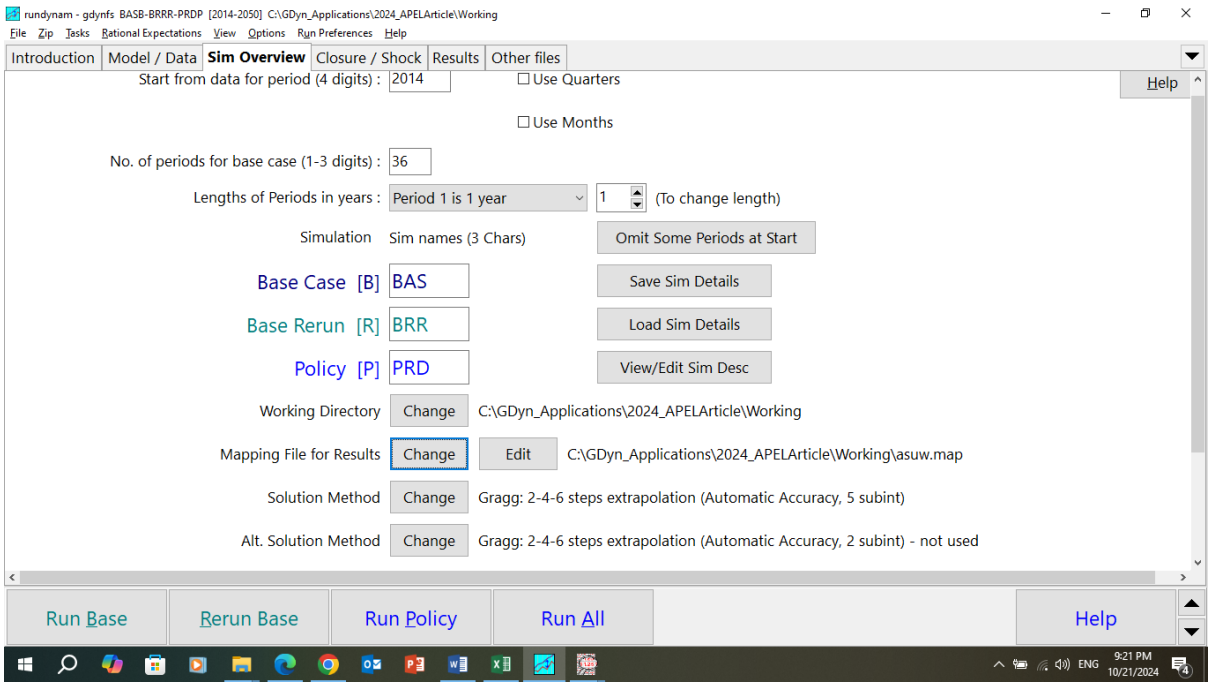
5 As the model and common closure do not vary between simulations, an alternative is to load just the closure and shock elements specific to the baseline scenario. This requires additional steps and is not covered in this note.

6 Note the executable image provided is created in the GEMPACK utility **Tabmate** (**TABLO STI** button, then the **TABLO LTG** button). This approach preserves the nominated name of the *.STI file through the **RunDynam Zip-Restore** process. The alternative is to create the image via the **winGEM** utility which does not preserve the nominated name through the **RunDynam Zip-Restore** process. This alternative assigns a default name commencing with the letter 'wg' and gives rise to additional text being included in the sti file.

Default directory sub-directory structure	*Possible alternative*	*Comment*
…\data	…\Data	No change. Sets, data and parameters files.
…\model	…\Model	Executable image of the model and other information files; plus TABLO and STI files if the exe file is to be recreated.[7].
…\extra	…\Aggregation	Aggregation scheme.
	…\ChartsTables	Final output in publication format.
	…\Results	Repository for results from successive simulations.
…\tabetc	…\Tabetc	TABLO and STI files (see Model subdirectory entry and f/n 2).
…\	…\Working	Simulation details, closure and shocks files; working directory during simulations; simulation output directory.
…\	…\Zip	Zip files created in RunDynam.

If an alternative directory structure is adopted, the **Sim Overview** page of **RunDynam** would need to be adjusted. For example, if the map and simulation details, closure and shocks files were to the placed in Working subdirectory, the **Sim Overview** entries would to be edited to appear as follows:

7 As noted, to generate a new executable image, it is necessary to place the *.tab and *.sti files in the …\model subdirectory in both the default case (or in any alternative directory structure adopted).



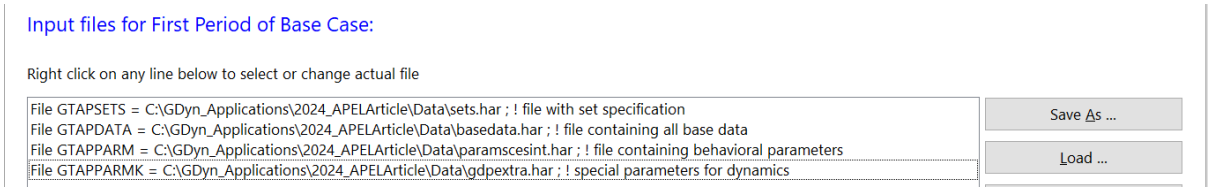
It should be noted that even if you adopt an alternative subdirectory structure, subsequent zipping via the **RunDynamic** utility will return the structure to the default setting shown above.

Appendix A GDyn-FS database and parameters

The database used is an eleven region by thirteen sector aggregation of the GTAP 9-GDyn database for 2014 (release R10A__2014_January2020). A sample aggregation scheme is provided in the accompanying file **Agg13x11_Sample.agg (**see **…\extras** subdirectory DN: **TO BE ADDED**). The aggregation provides a sets file, a year-specific database and two parameter files, one relating to standard GTAP parameters and another for additional parameters required for GDyn-FS.[8] The initial files were re-named as follows.

Initial name	*Study-specific name*	*Comment*
sets.har	sets.har	Set 'year' added
basedata.har	basedata_rorgtarg.har	To indicate country-specific target rates of return introduced
default.prm	paramscesint.har	Renamed to reflect treatment of intermediates. File extension *.har adopted.
gdgpextra.har	gdgpextra.har	Parameters CESCF, CETCF, CESCS, CESPG added

The input files for the first period of a base case appear in the **RunDynam Model/Data** screen as:

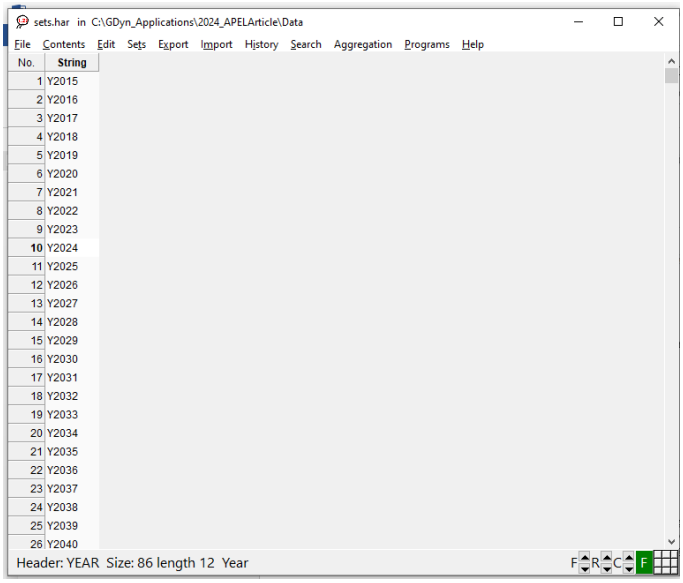


Sets addition

Add the set YEAR to the sets file with elements Y2015 to Y2100 to appear as:[9]

[8] As noted, the aggregation has 11 regions and 13 sectors. Greater regional or sectoral detail may be warranted for individual applications. Applications requiring more detailed combinations of regions and sectors may need to take account of disequilibria or idiosyncrasies in the originating data base requiring nuanced baseline assumptions, data revisions or additional theory.

[9] This may be done simply by importing the relevant set from the files provided with the release. This procedure can be similarly followed in the other revisions/additions described below.



Database change

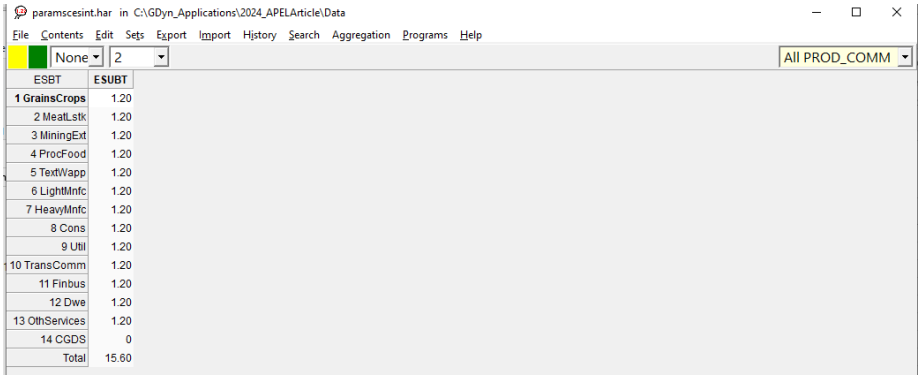
Calibrate target rate of return to regional gross rate of return to recognize differences in regional risk and institutions as represented in the starting database.

Parameter changes

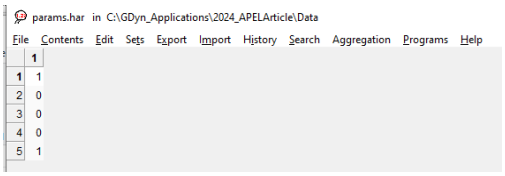
Parameter file - paramscesint.har

Relax the Leontief assumption on intermediate input use between inputs and between total intermediate inputs and value adding inputs via parameter ESUBT. The more flexible case is represented by a substitution elasticity of 1.2 which replaces the database value of zero (see Gretton 2021, section 2.3). The Leontief assumption is maintained for inputs to capital-goods supply (investment).

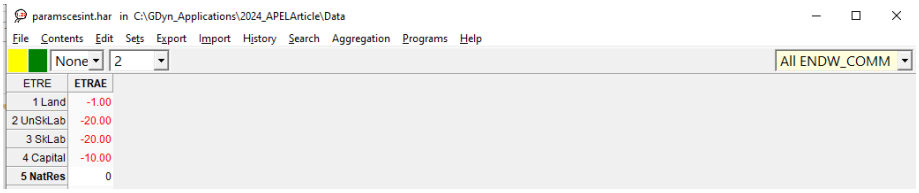
The values for the parameter ESUBT in the revised file appear as:



The modelling in Krisna et al. 2024 is made the standard assumption of perfect mobility of capital and labour between sectors (via SLUG=0 for labour and capital). The parameter settings appears as:



An alternative assumption would be to treat labour a capital as imperfectly mobile conditioned by the rate of transformation of labour and capital between sectors via the parameter ETRE with values of 20 for labour and 10 for capital from zero in the starting database (see section 2.3 Gretton 2021).[10] To afford this possibility, values for the parameter ETRAE in the revised file appear as:

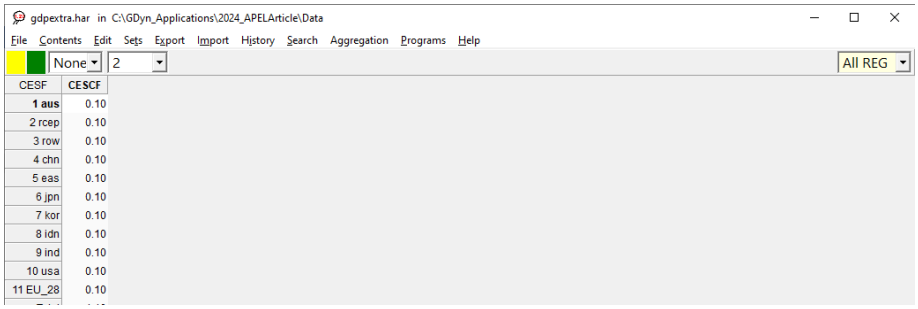


Parameter file – gdgpextra.har

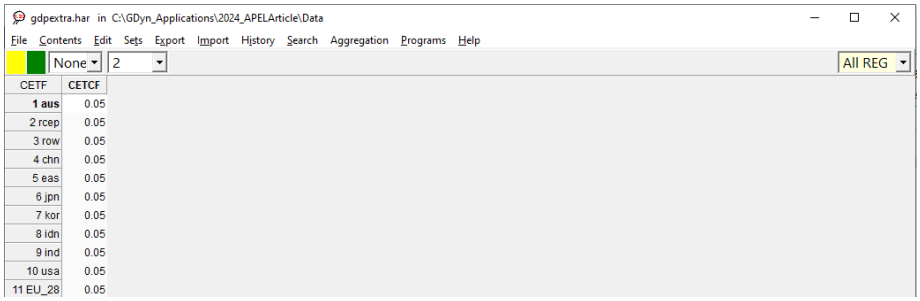
Introduce CES modelling of firms sourcing of finance via parameter CESCF and CET modelling of regional households' allocation of capital funds via the parameter CETCF (see Gretton 2021, section 2.3 and Appendix section A.3.3). Consistent with the home-country bias effect in the literature, the CESCF and CETCF parameters are set relatively close to the Cobb-Douglas case of zero (in the value function) of 0.1 and 0.05, respectively. The relativity between parameters reflects the notion that regional households have a greater bias towards investing at home than regional firms have in sourcing funds locally.

The values for the parameter CESCF in the extended file appear as:

10 It would also be necessary to change the parameter SLUG flags for labour and capital inputs (inputs 2,3,4) to 1 from zero in the standard parameters file used for this study. The interested reader may wish to undertake an addition sensitivity test with this setting.

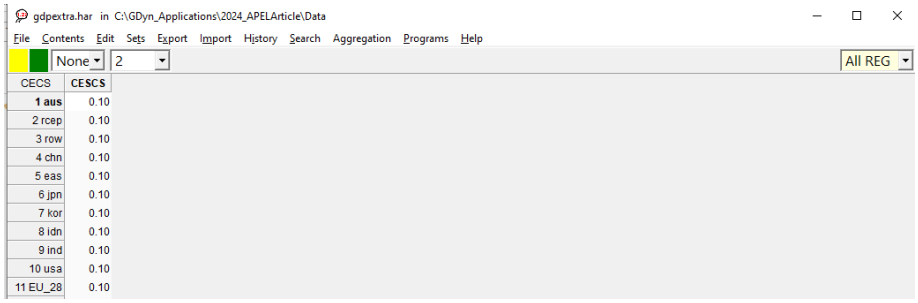


The values for the parameter CETCF in the extended file appear as:

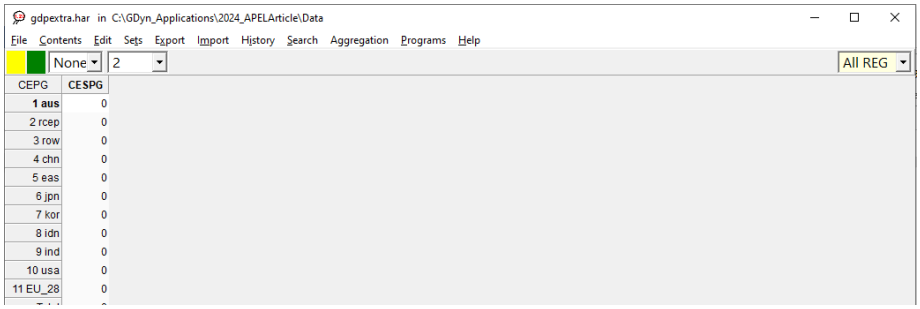


Introduce CES utility function in consumption-saving choices via parameter CESCS and private-government consumption choices via parameter CESPG (see Gretton 2021, section 2.3 and Appendix section A.4.2). In the case of the consumption-saving choice a parameter value (in the indirect utility function) of 0.1 is adopted. In the case of the private-government choice, the Cobb-Douglas constant share assumption of the original model is followed, that is, a parameter value of zero is adopted.

The values for the parameter CESCS in the extended file appear as:



The values for the parameter CESPG in the extended file appear as:



Appendix B Sample exercises

1. Repeat the simulation 2 applying identical shocks to another country/region (eg India (IND) or China (CHN)) and interpret the reasons for differences in results. Particular attention may be given to the country relativities with respect of the target gross rate of return on capital (RORGTARG), trade protection, and industry and trade orientation (Hint: look in GTAPDATA file for the base year for 'Base' on Results page. You may also look in the GDYNVIEW file. This is created post simulation so appears only from the first simulation year for the simulation elements Base, Base Rerun, Policy. On viewing via GDYNVIEW trace the paths of the coefficients on RORGTARG, RORGEXP and RORGROSS in the Base and Policy simulations. Pick another coefficient of interest and trace the path).

2. For simulation 2 and for country/region of choice, simulate the impacts of each component of the scenario and evaluate which components are of greatest economic importance at the national and sectoral levels. (Hint: in the scenario file (RunDynam interface\scenario2.psh view and comment out the elements not to be included in the test and save under a sub-scenario-specific name; select that new scenario in the Closure/Shocks page of the RunDynam interface.)

2. Noting footnote 9, formulate and conduct an additional sensitivity test on Scenario 2 applying the assumption of imperfect mobility of labour and capital across sectors (Hint: adjust the parameters file as indicated in footnote 9 and the save new parameters file under a difference name (eg paramscesintskl, with …skl for sticky capital and labour; select the new file in the model/data page of the RunDynam interface and select RunPolicy simulation. What error message(s) do you get? What responses may you make? (Hint: accept the error(s) and run just the policy simulation. Compare and interpret results between treatments for the policy simulation.[11]

3. Create a new database separating out another country of interest from one of the regional groups in the database provided. (Hint: it is suggested that the released database be: (i) re-created, (ii) checked against the release database for consistency; and (iii) scenario 2 simulated and checked before disaggregation is attempted. For the new disaggregated database, it is also suggested that scenario 2 be repeated for Indonesia and results confirmed before a simulation is conducted for the new country/region of interest.)

4. For scenario 2, extend the simulation period to 2100 adopting the Common closure from years 2051 to 2100. Re-simulate scenario 2 over the full period and inspect results for key variables such as GDP (qgdp), investment (qcgds), capital (qk) and rates of return (rorgt, rorge, rorga). What do you notice and Why? How might the results differ if a growth baseline had been provided to 2100? (Hint: view results from sensitivity test 1.) Repeat the exercise with respect to sensitivity test 1 and compare key results. (The interested reader may wish to examine and interpret the path of the coefficients error on the rate of return (ERRRORG) and the investment to capital (IKRATIO) across simulations.)

4. Consider a policy of interest pertinent to a country/region in focus, formulate a scenario around that policy, and simulate and interpret results.

[11] Additional exercise. On selecting the new parameters file run all simulation components combined. Do results of interest differ and why?