

Chapter 4

An Overview of the Dynamic GTAP Data Base: The Data Base Construction and Aggregation Programs

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1. Introduction

The GDyn Data Base, used with the Dynamic GTAP model, is based on the GTAP Data Base (Dimaranan, 2005), which describes the global economy in a given year (2001 for the GTAP 6 Data Base). The GTAP Data Base is augmented with additional data required for the Dynamic version of the GTAP model. This chapter covers the preparation of these additional elements of the GDyn Data Base,¹ and the manipulation and aggregation of the GDyn Data Base with various utility programs. The focus is on the additional data requirements, with minimal discussion of the dynamic parameters. Readers interested in the underlying GTAP Data Base are referred to Dimaranan (2006).

The GTAP data base (Dimaranan, 2006) is changed in the following three ways to obtain a database for GDyn:

- a) Six new arrays, listed in table 1, are added to the standard GTAP data file. The values of regional savings also change from those in the standard GTAP Data Base. The dimension of the array however does not change. These changes are discussed in section 2 below.
- b) A new parameters file contains the seven new parameters used in the dynamic theory (Table 2). The methodology for estimating econometrically, and in some

¹ We have occasion at various points to refer to specific versions of the GDyn data base. We use a version numbering system of the form <GTAP release>:<GDyn version>. The element <GDyn version> is of the form <GDyn major version>.<GTAPDyn minor version>. We declare a new major version to mark a major difference in data content; a new minor version, to mark a change in format or a minor change in content. For example, version 6:1.0 of the GDyn data base is based on release 6 of the GTAP data base. Version 6:2.0 is based on the same GTAP release, but incorporates more recent GDyn specific data. At the time of writing, the current version is 6:2.0.

cases calibrating these parameters, was examined in detail in chapter 3. In this chapter we outline the procedure for assigning values to these parameters in the standard GDyn Data Base. These changes are discussed in section 3 below.

c) One parameter array from the standard GTAP parameters file (Dimaranan, 2005) – RORDELTA – is not used in the new investment theory and can be deleted from the file.

Table 1: New Arrays in the Sandard Data file

Header name	Coefficient name	Dimensions	Units	Description
KHAT	KHAT	REG	$year^{-1}$	normal capital stock growth rate
RRGT	RORGTARG	REG	$year^{-1}$	target gross rate of return
YQHT	YQHTRUST	REG	\$US Millions	income of region from global trust
YQTF	YQTFIRM	REG	\$US Millions	income of global trust from firms in region
YQHF	YQHFIRM	REG	\$US Millions	income of region from local firms

Table 2 Contents of the Dynamic Parameters File

Coefficient Name	Dimensions	Description
INC	REG ²	initial income
LAMBKHAT	REG	coefficient of adjustment in estimated normal growth rate
LAMBRORGE	REG	coefficient of adjustment in expected rate of return
LAMBRORG	REG	coefficient of adjustment in rate of return
RORGFLEX	REG	elasticity of rate of return to capital with respect to capital stock
RIGWQH	REG	rigidity of allocation of wealth by regional household
RIGWQ_F	REG	rigidity of source of funding of enterprises

2. The GDyn Data File

We construct the new GDyn data as follows. First, we procure statistics for foreign income receipts and payments; from these and standard GTAP data we obtain the arrays: YQHT, the income from equity owned by each regional household in the global trust; YQTF, the income from equity owned by the global trust in each regions firms; and YQHF, local household income from ownership of equity in local firms. We then recognize that foreign income and receipts affects regional income. Since regional income must equal regional expenditure, regional expenditure must also change when foreign income is incorporated. Accordingly, we calculate new values for initial regional income, and regional expenditures are adjusted through a change in regional savings. The adjusted data on saving is stored in the standard data file under header SAVE.

Second, the normal rate of growth in the capital stock (KHAT) is estimated. The normal rate of growth in the capital stock is *perceived* by investors and assumed to converge to 1) the *actual* normal rate of growth in the capital stock, and 2) the actual capital stock growth rate in the long run equilibrium. To determine this perceived normal

² REG denotes number of regions in the GDyn model and GTAP data base.

growth rate of capital, time-series estimates for investment are collected and used to construct time series data for capital stock. The normal growth rate of capital (KHAT) is then set equal to the resulting geometric average growth rate of capital.

Third, the target gross rate of return, RORGTARG, is set uniformly across regions and equal to the world average actual gross rate of return. In previous versions of the GDyn Data Base (6:1.0 and lower) the expected gross rate of return (RORGEXP) was also included in the GDyn Data Base. In the release 6:2.0 of the GDyn Data Base, RORGEXP is calculated within the GDyn model code. This change was made to allow users to specify different values of LAMBRORG, upon which RORGEXP depends. RORGEXP is set individually in each region so as to reconcile the investment level implied by the investment theory with the level recorded in the data base.

Each of these stages is discussed in detail below.

Income and saving

For the GDyn data base version 6:2.0¹, the data reference year is 2001³. The standard country GDP data set is based on the macro country data set used in building the standard GTAP data base version 6, supplemented by estimates for 2001 from the CIA *World Factbook*.

For foreign income receipts and payments, we use the World Development Indicators (WDI) data set from the World Bank. For the GDyn data base version 6:2.0, we use the 2002 edition of the WDI. We extract two data series:

- Foreign income receipts (BoP, current US\$)
- Foreign income payments (BoP, current US\$)

We obtain foreign receipts data for 154 countries, and foreign payments data for 155. The foreign income payments and receipts shares in total income are also used to determine the share of foreign and domestic ownership of regional capital stocks. An alternative would be to use wealth/ownership data to imply the shares of income.⁴ Unfortunately, the set of countries for which wealth/ownership data are available is small and data for the correct base year unavailable. For example the Kraay et al. (2000)

³ Version 5:1.0 is based on data from 1997.

⁴ This approach was used in earlier versions of the GDyn Data Base.

database contains 1997 data for only 38 countries, significantly less than the 154 countries for which data on income are available. For this reason we choose to use income data and imply from this data wealth.

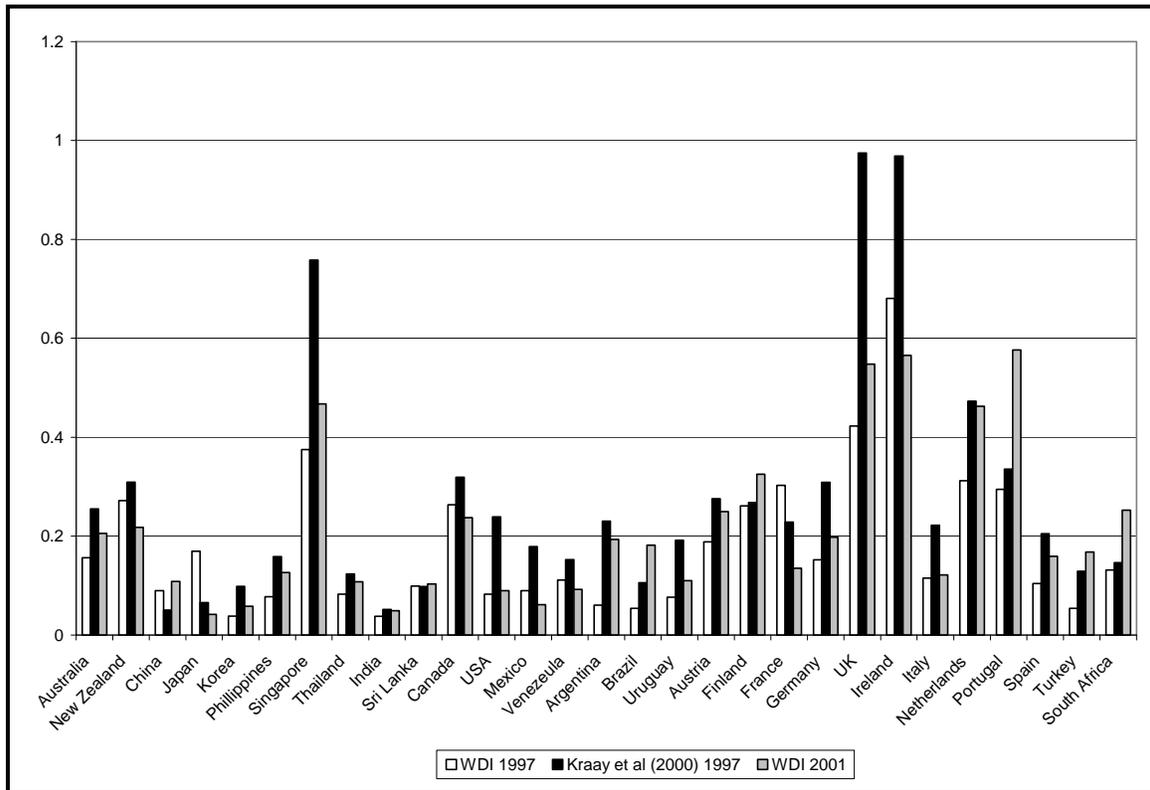
The foreign ownership shares of regional capital obtained from the foreign income payments and receipts WDI data for 1997 and 2001 are compared to the shares from Kraay et al. (2000) in figure 1. The data show that the share of foreign ownership is higher when wealth (Kraay et al., 2000) is used to calculate the shares, as opposed to income from the WDI, and that the 2001 shares of foreign ownership are higher than the 1997 shares, reflecting the fact that the share of foreign ownership has grown over this period. We should draw the attention to the comforting fact that the shares obtained from Kraay *et al.* data and the ones from WDI data follow the same cross-country pattern.

New foreign income and saving data are constructed in five steps and discussed in detail below:

- filling in missing values in the foreign income receipts data,
- filling in missing values in the foreign income payments data,
- balance foreign income receipts and payments,
- aggregate foreign income data from countries to GTAP regions, and
- calculate new values for income earned by domestic capital, total regional income, and saving, in each region.

The average ratio of foreign income receipts to GDP (FYRFFACT) is calculated, for countries for which we have foreign income data. Foreign income receipts data are extended to cover all standard countries, assuming that for the missing countries, the ratio of foreign income receipts to GDP is equal to the average ratio for countries for which data are available, that is, calculating the missing value of foreign income receipts for country c as $FYRFFACT * GDP(c)$. We take the GDP values from the standard country GDP data set. We use a similar calculation to extend the foreign income payments data to cover all standard countries.

Figure 1: Comparison of Share of Foreign Ownership based on Income and Wealth



Source: GDyn Data Base versions 5:1.0 and 6:2.0 and Kraay et al (2000).

The foreign income data are unbalanced. That is, the world total for foreign income receipts is not equal to the world total for foreign income payments. A new common target total is calculated as the geometric mean of the two new totals⁵. The data is then balanced by rescaling both receipts and payments to match the common target total, adjusting the values for all countries. The balanced foreign income data are then aggregated across countries to the GTAP regions. This gives us the arrays YQHT and YQTF.

Income from capital in each region (VOA) is then obtained from the standard GTAP standard data file. Subtracting foreign income payments (YQTF) from this we then obtain estimates for local income from domestic capital in each region (YQHF). In so doing, we assume implicitly that all foreign income payments are income from capital.

⁵ Total of all factor income payment/receipts for all standrad countries (including countries for which data was available and countries for which data was filled).

Taking account of the new foreign income payments and receipts data, we calculate new values for total income, INC, and for saving in each region, SAVE:

$$SAVE(r) = INCOME(r) - PRIVEXP(r) - GOVEXP(r) \quad \forall r \in REG$$

Where:

$$INCOME(r) = \sum_{i \in ENDWNA} VOA(i, r) + YQHHL D(r) + TAXREV(r) \quad \forall r \in REG$$

Normal Rates of Growth in Capital Stocks

For the normal rate of growth in the capital stock, KHAT, we use time series investment data (referred to below as the macro times series data⁶); as well as investment and capital stocks data for 2001 from the GTAP Data Base (referred to below as the single-year macro data set⁷). For version 6:2.0 of the GDyn data base, the macro time series data are available for 117 countries for the period 1990-2005 from the WDI, while the 2001 investment data from the standard GTAP data base are available for 226 countries⁸ (we refer to this list of 226 countries as the GTAP standard list of countries).

For each region we define the normal rate of growth in the capital stock as the rate at which the capital stock in that region can grow, without any increase or decrease in the rate of return. We store a region-specific parameter KHAT representing the normal rate of growth as estimated by investors in the data file. We proceed in five steps discussed in detail below:

⁶ The macro time series data set contains time series investment, GDP and other macro variables. In this chapter however we are only interested in the investment data.

⁷ The single-year macro data set also contains other macro data, including GDP, investment, capital stocks, consumption, government spending etc.

⁸ The single-year macro data for 2001 uses its own country classification, which is incomplete relative to the list of 226 countries upon which the GTAP Data Base is based. We fill in the gaps using GDP data from the World Bank which are consistent with the GTAP data. For investment, we calculate a scaling factor equal to the ratio of two sums over the countries covered in the single-year macro data set. The numerator is the sum of investment values from the macro data set; the denominator is the sum of GDP values from the standard country GDP data set. We apply this scaling factor to GDP values from the standard country GDP data set to fill in the investment values missing from the single-year macro data set. We use similar methods to fill in the missing countries in the macro data for capital stocks, GDP, and the rest. These procedures are undertaken as part of the standard GTAP data base construction procedures (Dimaranan, 2005).

- fill in missing values and disaggregate country groups in the macro time series data,
- from the capital stock data in the single-year macro data set, and the investment data in the macro time series data set, construct time series data for capital stocks,
- aggregate the capital stock time series data from countries to GTAP regions, and
- calculate the geometric average rates of growth in capital stocks, and set KHAT equal to those average growth rates.

As mentioned above the macro time series data set is available for 117 countries/regions. The dataset is therefore incomplete and somewhat aggregated relative to the standard GTAP country classification of 226 countries (notably, it treats the Soviet Union as a single country). We use data from the completed single-year macro data set to fill in missing values and disaggregate aggregate values.

We fill in the missing values in the investment time series by calculating for each year in the time series data a country-generic investment scaling factor equal to the ratio of two values for total investment in countries covered by the time series data, one value taken from the time series data set (denominator), the other from the single-year macro data set (denominator). We then apply these scaling factors to investment values for the required countries taken from the single-year macro data set. To disaggregate time series investment estimates for country aggregates, we use shares calculated from the investment data in the single-year data set. We fill in the missing countries in the GDP time series by calculating for each year in the time series data a country-generic GDP scaling factor, using the same approach as that taken for the investment scaling factor.

To disaggregate time series investment estimates for country aggregates, we use shares calculated from the GDP data in the single-year data set to apportion the aggregated investment time series data across the countries in the aggregated region.

We then use the single-year macro data set and the disaggregated (226 country level) macro time series data set to construct time series data for capital stocks in each country. Since the two input data sets may use different units, we first put them on a

common basis. To do this we rescale the investment time series using a country-specific scaling factor, the ratio of the GDP value from the single-year macro data set to the GDP value for the same reference year from the macro time series data set. This ensures that the 2001 time series investment data is equal to the investment in the 2001 single-year macro dataset and accounts for any differences in units. We then construct the capital stock time series data using the perpetual inventory method, taking for capital stock base values, the capital stock data from the single-year macro data set, for gross investment, the rescaled investment time series, and for the depreciation rate, a separately supplied country-generic value.

We aggregate the capital stock time series data from countries to GTAP regions. For each region, we set KHAT equal to the average actual rate of growth between the first and last year covered by the capital stock time series. The normal growth rates (KHAT) are within the range -1.9% to 14.5%, except Mozambique which has a KHAT of 22%.⁹

Target Rate of Return

Finally we include in the GDyn data file a region-dimension array RRG T. This is the array containing data on the target gross rate of return used by investors in allocating capital between regions (RORGTARG).

For each region, we set the target rate of return equal to the world average rate of return, which depends on the global earnings to capital (EKTOT) relative to the global value of capital (VKTOT).

$$\text{RORGTARG} = \frac{\text{EKTOT}}{\text{VKTOT}} = \left[\frac{\sum_{i \in \text{Capital}} \sum_{r \in \text{REG}} \text{VOA}(j, r)}{\sum_{r \in \text{REG}} \text{VK}(r)} \right]$$

where:

VOA(i,r) is the value of output at agents prices of capital in region r;

VK(r) is the value of capital stocks in region r.

⁹ This is most likely due to the very low value of capital stocks in Mozambique in 2001 relative to the high value of investment in 2001.

Thus, in the data base, though not necessarily in the model theory, target rates of return are uniform across regions.

3. Parameters

The new behavioral parameters must then be included in a new dynamic parameters file. For all the arrays in the parameters file, except for initial income INC, the values set are based on the results of the empirical analysis undertaken in chapter 3. For a more detailed explanation of the parameters used in the GDyn model the reader is referred to chapter 3. Here we summarize the GDyn parameters and provide a brief account of their chosen default values in the GDyn Data Base.

INC

The first new parameter, listed in Table 1, is INC. This parameter is the initial income level in US\$ millions in the initial GDyn data base. It is used for calculating welfare measures in multi-period experiments and remains unchanged over the simulation and time.

Lagged Adjustment Parameters

The lagged adjustment parameters include: LAMBRORG, the coefficient of adjustment in actual rate of return; LAMRORGE, the coefficient of adjustment in expected rate of return; and LAMBKHAT, coefficient of adjustment in perceived normal growth rate of capital stock. In the standard GDyn 6:2.0 Data Base, LAMBRORG and LAMRORGE are set equal to 0.4, and LAMBKHAT is set equal to 0.2 for all regions. Using the calibration procedures, outlined in chapter 3, we find that these values lead to empirically consistent convergence of the rates of return in a typical GDyn aggregation (approx. 10 regions), and reduce the occurrence of negative investment. Those readers wishing to calibrate these parameters to their own aggregation or alter the values to obtain alternative rates of convergence are referred to Chapter 3 for further details on the calibration procedure and effects associated with altering these parameters.

Flexibility of Gross Rate of Return

RORGFLEX is the elasticity of rate of return to capital with respect to capital stock. This parameter is set equal to 1 for all regions, which was shown in chapter 3 to be close to the true value of RORGFLEX given the settings for LAMBRORG stated above.

The true values of RORGFLEX can be obtained via calibration following the techniques outlined in chapter 3. It is highly recommended that users do not alter RORGFLEX arbitrarily, as large differences between the chosen and true values can adversely affect convergence properties of the model (see chapter 3).¹⁰

Rigidity Parameters

There are two rigidity parameters in the GDyn model: RIGWQH, which is the rigidity of allocation of wealth by regional household; RIGWQ_F, the rigidity of source of funding of enterprises. We use the empirical estimates of rigidity parameters (as specified in Table 7 in Chapter 3) to obtain rigidity parameters for the 226 standard GTAP countries. The following procedure is used:

Rigidity estimates for 57 countries and 5 regions, including Benelux, were provided in chapter 3. After applying the rigidity parameters of Benelux to Belgium and Luxembourg, data for 59 countries are available. Of these 59 countries, 42 countries are contained in the GTAP 6 Data Base. For these 42 countries in the GTAP 6 Data Base the country specific rigidity estimates come from Table 7 in Chapter 3. The rigidity parameters for the 4 regions¹¹ from Table 7 in chapter 3 were then assigned to the 16 GTAP regional groupings used in the production of the GTAP 6 Data Base according to Table 3 below¹². The remaining standard countries (226 less 42) were then assigned the rigidity parameters of the region (one of 16) to which they belonged¹³.

¹⁰ It should also be noted that calibrated RORGFLEX is dependent on LAMBRORG and hence changes in LAMBRORG affect the true value of RORGFLEX. If users choose calibrated RORGFLEX, as opposite to RORGFLEX=1, and wish to alter LAMBRORG, they are advised to recalibrate RORGFLEX to obtain new true value.

¹¹ All Industrialized countries, All Latin America, All East Asia Pacific and All.

¹² Note that the rigidity estimates for the remaining 17 (59 less 42) countries not in the GTAP 6 Data Base were not used due to aggregation problems. The alternative would have been to allocate estimates to all 226 countries and then aggregate the parameters of the countries to obtain regional estimates. This method was not used because of the lack of country estimates to aggregate for those regions and the difficulties in obtaining data for weighting such an aggregation.

¹³ Since all the regional rigidity parameters were similar, this allocation method did not yield any real differences between regions and hence where countries within the region were not included in the econometrics the parameters for 'ALL' were used.

Table 3: Allocation of Rigidity Parameters across 16 GTAP Regional Groupings

	Based on the following countries/regions from Table 7 in chapter 3:	<i>RIGWQH</i>	<i>RIGWQ_F</i>
Oceania	All	0.06	1
East Asia	ALL EAP	0.01	1
South East Asia	ALL EAP	0.01	1
South Asia	All	0.06	1
North America	All	0.06	1
South America	All LAC	0.13	1
Central America	CRI, SLV, GTM, HND, NIC	0.01	1
Caribbean	All	0.06	1
Europe	All	0.06	1
Eastern Europe	All	0.06	1
Former Soviet Union	All	0.06	1
Middle East	All	0.06	1
North Africa	All	0.06	1
Southern Africa	All	0.06	1
Central and Eastern Africa	All	0.06	1
Western Africa	All	0.06	1

The rigidity parameters for the 226 countries were then aggregated up to the 87 regions in the GTAP 6 Data Base, using simple averages. Since all countries not covered in the GTAP Data Base as separate regions, but presented as regions composites, are assigned regional averages, the weight used to aggregate are irrelevant.

3. Creating Aggregations of the GDyn Data Base and Parameters

The aggregation program developed for the GDyn model allows the user to aggregate up the data base and parameters from the GTAP regional and sectoral level to

an aggregation which can be used in their analysis/ application. In developing the aggregation procedure, issues arise concerning the choice of aggregation formulae. It is not obvious that all parts of the aggregate data base should be constructed by aggregating the original data base. Alternative methods such as calibration suggest themselves for some parameters. Furthermore, for some parameters, it is not obvious what aggregation formulae should be used. In general, we calculate aggregate parameters as weighted averages of disaggregate parameters; but the choice of weights is not always obvious.

In earlier versions, the parameters KHAT and RORGFLEX were set by an iterative procedure involving calibration simulations with the GDyn model. This was done after aggregation. This however cuts across our goal of providing a quick and easy aggregation procedure. In the latest version of the GDyn Data Base, we determine the aggregate KHAT and RORGFLEX parameters not by post-aggregation calibration but by applying simple aggregation formulas.

With this approach, KHAT and RORGFLEX are unlikely to match exactly with the underlying or "true" parameters. This raises no particular problems for KHAT. The model theory does not require that it should agree with the true normal rate of growth in the capital stock, since KHAT is a self-correcting parameter that varies through time to eliminate divergences between the perceived and true rate of normal growth. RORGFLEX, on the other hand, is not self-correcting and problems associated with the aggregation of RORGFLEX and the other parameters may arise as discussed in chapter 3.

KHAT

The parameter KHAT is updatable and therefore held in the data file. In aggregating it, we use capital stock weights calculated from the array VKB in the data file.

$$AKHAT(n) = \sum_{\forall r \text{ in region } n} \left[\frac{VKB(r)}{AVKB(n)} \cdot KHAT(r) \right] \quad \forall r \in REG, \forall n \in AREG$$

Where:

AKHAT(n) is the aggregated KHAT for region n;

VKB(r) is the value of capital stocks for country r (in aggregated region n);

AVKB(n) is the aggregated value of capital stocks for the region n; and

KHAT(r) is the normal growth rate of capital for country r (in aggregated region n).

RORGFLEX

The parameter RORGFLEX represents the elasticity of the expected rate of return with respect to the capital stock. The aggregate elasticity,

$$\phi = \frac{\partial \log R_E}{\partial \log K}$$

Where: R_E represents the expected (gross) rate of return and K the capital stock.

Letting the subscript i run over the corresponding disaggregate regions, we have

$$R_E = \frac{E}{K} = \sum_i \frac{E_i}{K} = \sum_i \frac{R_{E,i} K_i}{K}$$

where E represents earnings; so

$$d \log R_E = \sum_i S_{E,i} d \log R_{E,i} + \sum_i S_{E,i} d \log K_i - d \log K \quad (1)$$

Where: $S_{E,i}$ represents the share of region i in aggregate capital earnings. Then, assuming uniform relative change in the capital stock, assuming that is, that for all disaggregate regions i , $d \log K_i = d \log K$, we have:

$$d \log R_E = \sum_i S_{E,i} d \log R_{E,i}$$

So

$$\phi = \sum_i S_{E,i} \frac{\partial \log R_{E,i}}{\partial \log K} = \sum_i S_{E,i} \frac{\partial \log R_{E,i}}{\partial \log K_i} = \sum_i S_{E,i} \phi_i$$

So for RORGFLEX, earnings weights are appropriate. More precisely, since the rate of return in question is the expected not the actual rate of return, we should use expected not actual earnings weights. Note that the assumption of uniform capital stock growth is not innocuous: we should have obtained a different aggregation formula if we had assumed, for example, uniform relative change in the rate of return.

LAMBORGE

The parameter LAMBORGE is used to define the error-correction effect for the expected rate of return:

$$\frac{\partial \log RE}{\partial t} = E \Lambda_{R_E}$$

Where: E is a measure of error. Recalling equation 1, and putting

$$\frac{\partial \log K_i}{\partial t} = \frac{\partial \log K}{\partial t}, \text{ we have again:}$$

$$d \log R_E = \sum_i S_{E_i} d \log R_{E_i}$$

Then:

$$\begin{aligned} \Lambda_{RE} &= \frac{1}{E} \sum_i S_{E_i} \frac{\partial \log R_{E_i}}{\partial t} \\ &= \frac{1}{E} \sum_i S_{E_i} E_i \Lambda_{R_{E_i}} \end{aligned}$$

Then, assuming uniform errors E_i (or no correlation between errors E_i and speed of adjustment $\Lambda_{R_{E_i}}$), we have:

$$\Lambda_{R_E} = \sum_i S_{E_i} \Lambda_{R_{E_i}}$$

So again, expected earnings weights are appropriate. Given the parameters for all regions are set equal to 0.2 the aggregation procedure is not relevant under the standard settings; however, if changes are made to specific countries/regions this would become an issue. This is also true for the aggregation of LAMBRORG and LAMBKHAT.

LAMBRORG

The parameter LAMBRORG represents the derivative of the required rate of growth in the rate of return with respect to a measure of divergence between the expected and the target rate.

At any time t , investors hold a perception or expectation not only of the current rate of return, but also of the rate of return at future times. They require that this expected rate of return should grow through time at a rate that depends on the divergence between the expected and the target rate. If the expected rate exceeds the target rate, the expected rate should grow at a positive rate; if the target rate exceeds the expected rate, the expected rate should decline. The derivative of the rate of growth in the expected rate of return with respect to the measure D of divergence is LAMBRORG or Λ_{R_R} .

Now:

$$\Lambda_{R_R} = \frac{\partial}{\partial D} \frac{d \log RE}{d t}$$

so, again recalling equation 1, and assuming $\frac{\partial \log K_i}{\partial t} = \frac{\partial \log K}{\partial t}$, we have:

$$\Lambda_{R_R} = \frac{\partial}{\partial D} \sum_i S_{E_i} \frac{d \log R_{E_i}}{d t}$$

Then, ignoring any effect of change in divergence on the earnings shares, we have:

$$\Lambda_{R_R} = \sum_i S_{E_i} \Lambda_{R_{R,i}}$$

So once again, we use expected earnings weights. As in the case of LAMBRORGE, LAMBRORG parameters for all regions are set equal to 0.2.

LAMBKHAT

The parameter LAMBKHAT or $\Lambda_{\hat{K}}$ represents the derivative of the expected normal rate of growth in the capital stock with respect to a measure of error in expectations:

$$\begin{aligned} \Lambda_{\hat{K}} &= \frac{\partial}{\partial E} \frac{d \log \hat{K}}{d t} \\ &= \frac{\partial}{\partial E} \sum_i S_{K_i} \frac{d \log \hat{K}_i}{d t} \\ &= \sum_i S_{K_i} \Lambda_{K_i} \end{aligned}$$

So for LAMBKHAT we use capital stock weights. Again the parameters for all regions are set equal to 0.2.

RIGWQH

The parameter RIGWQH describes the rigidity of the allocation of the wealth of the regional household between local and domestic assets. To aggregate it we use the wealth of the regional household (coefficient WQHHL) for weights.

RIGWQ_F

The parameter RIGWQ_F describes the rigidity of the sourcing of funds of enterprises between locally and foreign sources. To aggregate it we use the value of the domestic capital stock (coefficient WQ_FIRM) for weights¹⁴.

References

Dimaranan, Betina V., Editor (2005). *Global Trade, Assistance, and Production: The GTAP 6 Data Base*, Center for Global Trade Analysis, Purdue University.

¹⁴ If we derived the weights to be used with RIGWQH and RIGWQ_F with the same level of care as the earlier parameters, we would obtain some strange formulae, in which the weights sum to less than one, except in the special case that the composition of wealth (for RIGWQH) or sourcing of funds (for RIGWQ_F) is uniform across disaggregate regions within disaggregate regions. This is similar to the situation we meet with domestic / import or factor substitution elasticities (details available on request). In those situations in standard GTAP, we ignore the complexities, and use plain weights summing to one; we do the same here. Then the choice of weighting coefficient can be justified by this argument: For RIGWQH, as the share of some disaggregate region in the aggregate region's wealth approaches one, the aggregate region's rigidity parameter should approach that disaggregate region's parameter; similarly for RIGWQ_F and domestic capital.