

Chapter 6

Macroeconomic Data

Angel H. Aguiar

This chapter provides an overview of the macroeconomic features of the GTAP 9 Data Base. We will first present how the macroeconomic data base is collected and processed. Then, the section will focus on highlighting the salient features of the uses of Gross Domestic Product in the construction of the GTAP Data Base.

6.1 *Data Sources and Processing*

Our primary source of macroeconomic data is the World Development Indicators (WDI).¹ This World Bank data is a suitable source of data for GTAP since it covers a wide range of countries and includes data that is already reconciled for statistical discrepancies. From the World Bank data base, we obtained data on GDP, GDP aggregates (private consumption, government consumption, and gross fixed capital formation), and population. The GDP and GDP aggregates data are in millions of current US dollars. For some countries, GDP and population data were not available in WDI, for those countries we compiled data from other sources such as the UN Statistics Division and the CIA World Factbook among others.

The construction of the GTAP Data Base does not directly require data on exchange rates. All the coefficients in the regional I-O tables are simply scaled up to match the GDP reference year. Since most the GDP data comes from the World Bank's data base, the underlying exchange rate is the Atlas conversion factor² that is used by the World Bank in its national accounts data.

Estimates of the GDP aggregates were generated for the countries for which only GDP and population data are available. This was done by first mapping the 244 countries with a smaller number of 19 geographic regions. For each geographic region, the average share of each GDP aggregate to total GDP was calculated for the countries for which GDP aggregates data are available. Estimates of the GDP aggregates were then generated for the countries with no GDP aggregates data by multiplying GDP of each country with the average share of the aggregate in the geographic region to which the country belongs. The estimates for each GDP aggregate were then summed up

¹ WDI reports calendar year data, for the methodology behind please refer to this document: <http://data.worldbank.org/sites/default/files/wdi-2013-backmatter.pdf>

² The Atlas conversion factor for any year is the average of a country's exchange rate (or alternative conversion factor) for that year and its exchange rates for the two preceding years, adjusted for the difference between the rate of inflation in the country and, for 2001 onwards, that in countries including the Euro Zone, Japan, the United Kingdom, and the United States. A country's inflation rate is measured by the change in its GDP deflator (<http://www.worldbank.org/data/aboutdata/working-meth.html>).

for each GTAP region after estimates have been generated for the data gaps. This practice is based on the assumption that a country would have a similar macroeconomic profile to its neighboring countries.

Since GTAP 6 Data Base, GDP aggregates (private consumption, gross fixed capital formation, and government consumption) are scaled in order to maintain consistency of the collected GDP data with the reconciled trade data (see Chapter 9). The reconciled trade data do not match the total exports and imports in the World Bank dataset, therefore, if we do not scale the GDP aggregates, the resulting final GDP will be different than that of World Bank's GDP totals.

Finally, we would like to highlight the fact that since Version 7, the GTAP Data Base has released updates for the 2004 reference year. While some data remain the same, there are some notable changes. The first major difference is the expansion of standard country set from 226 to 244 that occurred between version 7 and 8. The additional 18 regions are small countries (both in terms of GDP and population) and are not countries for which we have IO tables. The second issue is that additional regions change the composition of some of the GTAP composite regions, a fact we should keep in mind when comparing version 7 against Versions 8 or 9. Third, for the remaining regions the 2004 base year data in Version 8 represents a substantial improvement to that of Version 7 data base. For Version 7 we used World Bank data for 130 countries, leaving us to collect data from other sources for the other 96 countries. For Versions 8 and 9, the WDI had both expanded its country coverage and updated the 2004 macroeconomic data. As a result, we collected GDP data for 190 countries from WDI and 54 from other sources.

For a few of the tiny countries/territories, GDP data is missing or zero, but population data is available. For such countries, we assumed the per-capita GDP to be the average per-capita-GDP of the corresponding geographical region to calculate the approximate GDP. For South Georgia and the South Sandwich Islands and Heard and MacDonald Islands, there was no data on GDP or population, so we assumed zero for these territories.

6.2 *Uses of Macroeconomic Data*

During the GTAP Data Base construction process, macroeconomic data are used in various stages. The primary use of macroeconomic data is in updating the regional input-output (I-O) tables to a common base year. As a first step, all the coefficients in the regional I-O tables, initially in national currency units, are scaled-up by the ratio of gross domestic product (GDP) calculated from the I-O tables to external GDP data in current US dollars. Then, data on GDP aggregates – private consumption (C), gross fixed capital formation (I), and government consumption (G) are used in the FIT process to update the values of these aggregates in the regional I-O tables (see Chapter 15.A).

Per capita GDP data are also required in the construction of input-output tables for composite regions, i.e. the aggregate regions for which input-output data are generated based on the I-O tables of the primary regions. Similar per capita GDP is used as a criterion for matching a member country in a composite region to one of the primary regions within the same geographic area (See Chapter 8.E). A combination of one or more primary region I-O tables is then used to generate an I-O table for a composite region.

Macroeconomic data are also used in extending various data sets to the standard country coverage and as weights for aggregating data from standard countries to GTAP regions.

Macroeconomic data, particularly GDP and GDP shares, are used in extending the trade datasets (Chapter 9) to 244 standard countries in the GTAP 8 Data Base. GDP data are also used as weights for aggregating data on domestic support, factor shares (Chapter 12.A), and labor shares (Chapter 12.B) from standard countries to GTAP regions. Finally, macroeconomic data, government consumption and GDP are used to check and potentially revise the share of government consumption in each I-O table. This procedure imposes a more uniform treatment of government consumption expenditure across countries and is explained in greater detail in Chapter 8.E.

6.3 *Capital Stock and Depreciation*

The GTAP Data Base also reports data on physical capital stock and depreciation. Capital stock data was collected from the Penn World Tables version 8.0.3

From the Penn World Tables we collect 167 countries for the three reference years in GTAP. Similar to the procedure for filling data gaps in the GDP aggregates data, data gaps for capital stock were filled by first calculating the average ratio of capital stock to GDP for the countries for which capital stock data are available. Estimates of capital stock were then generated for the countries with no capital stock data by multiplying GDP in each country with the average ratio of capital stock to GDP in the geographic region to which the country belongs. The capital stock estimates were then summed up for each region after estimates have been generated for the data gaps.

Capital depreciation is estimated at four percent of the physical capital stock for both base years. The last two columns of Table 6.1 present capital stock and depreciation data in millions of 2011 US dollars, respectively for the 140 regions of the GTAP 9 Data Base.

³ <http://www.rug.nl/research/ggdc/data/pwt/pwt-8.1>

Table 6.1 Macroeconomic Data (2011 US\$ Million)

Regions	Gross Domestic Product	Private Consumption	Gross Fixed Capital Formation	Government Consumption	Capital Stock	Depreciation
Australia	1,387,013	746,730	370,097	247,140	5,149,000	205,960
New Zealand	163,841	96,624	30,646	32,409	441,545	17,662
Rest of Oceania	44,376	31,099	14,125	11,809	156,392	6,256
China	7,321,875	2,658,237	3,375,387	988,370	26,018,896	1,040,756
Hong Kong	248,516	157,718	58,647	21,707	793,342	31,734
Japan	5,905,634	3,523,851	1,203,859	1,191,584	25,670,184	1,026,807
Korea	1,202,462	634,293	372,468	172,960	4,406,185	176,247
Mongolia	8,761	4,147	4,180	1,103	47,667	1,907
Taiwan	464,009	249,715	86,015	51,503	1,130,319	45,213
Rest of East Asia	52,323	23,760	15,503	8,103	122,346	4,894
Brunei Darassalam	16,691	4,713	3,283	4,258	44,796	1,792
Cambodia	12,830	10,879	2,111	796	29,917	1,197
Indonesia	845,925	486,797	274,430	77,459	2,711,152	108,446
Lao People's Dem. Rep.	8,254	5,967	2,266	840	28,731	1,149
Malaysia	289,260	148,338	69,932	40,809	1,128,134	45,125
Philippines	224,095	175,355	44,676	23,155	769,604	30,784
Singapore	274,065	107,310	74,761	28,570	1,154,118	46,165
Thailand	345,670	197,975	93,580	47,231	1,359,273	54,371
Viet Nam	135,540	108,191	42,374	9,340	564,981	22,599
Rest of Southeast Asia	56,480	35,658	16,986	7,262	199,565	7,983
Bangladesh	111,906	84,650	27,374	6,296	356,467	14,259
India	1,880,100	1,171,620	635,209	227,768	4,334,710	173,388
Nepal	18,850	16,432	4,602	2,058	71,997	2,880
Pakistan	213,686	188,064	29,000	22,551	546,561	21,862
Sri Lanka	59,178	43,429	16,850	9,199	171,005	6,840
Rest of South Asia	21,874	22,211	5,139	3,281	59,030	2,361
Canada	1,778,628	980,349	412,007	381,750	5,247,259	209,890
United States of America	15,533,784	10,887,626	2,874,598	2,567,570	48,068,048	1,922,722
Mexico	1,170,083	762,745	246,233	130,960	3,125,379	125,015
Rest of North America	8,199	5,415	2,772	2,406	16,121	645
Argentina	557,727	361,820	104,024	78,269	1,906,264	76,251
Bolivia	23,949	16,101	5,014	3,642	59,753	2,390
Brazil	2,476,695	1,485,873	474,816	509,252	9,073,123	362,925
Chile	251,162	152,149	55,716	30,168	762,927	30,517
Colombia	335,416	204,447	78,819	53,745	1,203,036	48,121
Ecuador	76,770	47,229	21,431	10,414	305,416	12,217
Paraguay	25,071	19,432	4,541	2,940	64,443	2,578
Peru	170,564	102,593	41,026	17,520	655,984	26,239
Uruguay	47,237	33,141	9,039	6,272	158,419	6,337
Venezuela	316,482	188,471	60,583	39,353	960,824	38,433
Rest of South America	11,835	6,950	3,453	1,834	46,022	1,841
Costa Rica	41,237	23,653	7,258	6,497	79,010	3,160
Guatemala	47,655	39,886	6,919	4,764	74,005	2,960
Honduras	17,710	12,276	3,865	2,540	43,938	1,758

Regions	Gross Domestic Product	Private Consumption	Gross Fixed Capital Formation	Government Consumption	Capital Stock	Depreciation
Nicaragua	9,898	8,002	1,972	579	17,654	706
Panama	33,270	32,540	12,787	6,034	53,715	2,149
El Salvador	23,139	21,566	3,321	2,556	113,502	4,540
Rest of Central America	1,489	865	166	193	1,447	58
Dominican Republic	55,433	47,440	8,936	4,035	146,632	5,865
Jamaica	14,434	12,285	2,998	2,262	38,565	1,543
Puerto Rico	100,353	78,758	12,983	14,201	219,251	8,770
Trinidad and Tobago	23,676	9,151	2,680	2,482	25,636	1,025
Caribbean	109,228	69,329	18,661	34,203	232,188	9,288
Austria	415,983	235,230	90,706	81,111	1,403,034	56,121
Belgium	513,316	297,907	116,912	137,999	1,783,639	71,346
Cyprus	24,851	18,665	4,585	5,527	107,863	4,315
Czech Republic	216,060	109,450	52,182	44,825	775,849	31,034
Denmark	333,743	163,285	58,192	95,112	1,209,164	48,367
Estonia	22,543	13,176	6,177	5,035	69,240	2,770
Finland	262,378	150,342	52,444	65,909	1,019,964	40,799
France	2,777,492	1,622,233	559,570	682,196	10,080,064	403,203
Germany	3,628,099	2,104,634	664,627	701,729	11,173,211	446,928
Greece	289,886	233,446	47,409	54,396	1,139,518	45,581
Hungary	137,451	90,690	24,622	14,754	434,347	17,374
Ireland	226,034	90,432	19,709	34,077	438,644	17,546
Italy	2,196,334	1,377,401	428,521	457,573	9,824,561	392,982
Latvia	28,480	20,674	7,359	5,135	88,498	3,540
Lithuania	43,083	31,780	8,657	9,301	99,648	3,986
Luxembourg	58,009	31,429	18,343	16,551	214,345	8,574
Malta	9,302	9,417	2,139	3,014	27,618	1,105
Netherlands	832,751	380,774	149,734	234,453	2,382,736	95,309
Poland	515,771	334,889	110,697	98,528	1,373,813	54,953
Portugal	237,888	158,905	43,291	47,936	995,775	39,831
Slovakia	95,877	57,269	22,431	18,089	269,181	10,767
Slovenia	50,250	31,258	10,463	11,075	215,737	8,629
Spain	1,454,530	876,699	310,001	317,899	5,857,728	234,309
Sweden	535,997	260,932	101,606	144,285	1,134,734	45,389
United Kingdom	2,462,479	1,672,574	372,027	568,301	6,084,913	243,397
Switzerland	658,867	392,263	140,710	75,377	1,920,845	76,834
Norway	490,812	210,187	100,297	110,112	1,226,300	49,052
Rest of EFTA	20,126	12,637	3,785	4,969	84,265	3,371
Albania	12,891	10,895	3,883	1,451	51,893	2,076
Bulgaria	53,543	37,002	12,776	9,311	139,573	5,583
Belarus	59,734	37,105	23,848	9,453	164,956	6,598
Croatia	61,521	38,206	12,447	12,595	239,117	9,565
Romania	182,611	135,016	48,632	11,824	573,398	22,936
Russian Federation	1,904,795	943,099	415,796	351,514	6,738,264	269,531
Ukraine	163,422	115,358	31,837	31,263	800,936	32,037

Regions	Gross Domestic Product	Private Consumption	Gross Fixed Capital Formation	Government Consumption	Capital Stock	Depreciation
Rest of Eastern Europe	7,016	7,342	1,771	1,531	26,210	1,048
Rest of Europe	104,060	74,835	20,269	21,203	342,911	13,716
Kazakhstan	188,050	90,243	41,123	21,202	636,201	25,448
Kyrgyzstan	6,198	8,118	2,336	1,774	11,670	467
Rest of Former Soviet Union	81,079	33,480	26,619	13,823	200,218	8,009
Armenia	10,142	8,375	2,621	1,298	27,494	1,100
Azerbaijan	65,952	25,434	13,774	6,914	111,459	4,458
Georgia	14,435	12,606	3,675	3,064	39,897	1,596
Bahrain	29,044	14,729	5,947	5,231	145,208	5,808
Iran Islamic Republic of	528,425	254,146	138,935	64,082	1,618,593	64,744
Israel	258,216	149,643	53,379	60,174	727,516	29,101
Jordan	28,840	25,380	7,987	7,455	142,785	5,711
Kuwait	160,600	33,870	23,835	21,750	478,002	19,120
Oman	69,972	20,326	17,873	11,677	234,932	9,397
Qatar	169,805	19,642	54,162	22,857	459,340	18,374
Saudi Arabia	669,509	186,637	155,713	133,610	2,441,129	97,645
Turkey	774,754	567,665	173,994	111,039	1,432,511	57,300
United Arab Emirates	348,596	238,361	101,463	33,734	971,303	38,852
Rest of Western Asia	334,511	194,231	67,052	52,719	925,956	37,038
Egypt	236,001	188,579	42,208	28,575	475,027	19,001
Morocco	99,211	62,827	32,732	19,439	362,312	14,492
Tunisia	45,951	30,523	10,238	8,368	168,696	6,748
Rest of North Africa	234,696	85,137	76,432	59,867	619,402	24,776
Benin	7,298	9,984	2,299	1,513	20,459	818
Burkina Faso	10,396	5,940	1,540	1,776	24,297	972
Cameroon	25,487	17,847	4,955	3,813	59,972	2,399
Cote d'Ivoire	24,074	16,398	1,992	3,394	40,283	1,611
Ghana	39,564	27,060	11,684	7,594	94,840	3,794
Guinea	5,068	5,022	985	591	12,579	503
Nigeria	411,744	281,544	68,760	36,552	543,668	21,747
Senegal	14,441	12,211	3,718	2,573	58,786	2,351
Togo	3,756	4,783	981	514	10,995	440
Rest of Western Africa	29,424	29,446	11,917	5,098	91,057	3,642
Central Africa	63,540	19,537	24,312	5,281	138,297	5,532
South Central Africa	127,949	63,490	15,770	22,069	331,737	13,269
Ethiopia	31,368	24,737	8,767	2,718	73,584	2,943
Kenya	34,313	28,287	7,234	6,398	75,502	3,020
Madagascar	9,854	7,670	1,533	887	30,332	1,213
Malawi	5,628	4,006	740	1,284	24,851	994
Mauritius	11,252	8,738	2,857	1,610	34,643	1,386
Mozambique	12,548	8,640	3,945	1,404	21,377	855
Rwanda	6,408	4,757	1,292	507	8,997	360

Regions	Gross Domestic Product	Private Consumption	Gross Fixed Capital Formation	Government Consumption	Capital Stock	Depreciation
Tanzania	23,872	15,729	8,576	3,895	58,825	2,353
Uganda	15,493	11,308	3,350	1,328	25,082	1,003
Zambia	19,202	8,821	4,219	3,065	57,918	2,317
Zimbabwe	10,956	10,394	2,037	1,943	1,846	74
Rest of Eastern Africa	78,748	55,088	15,289	10,506	105,483	4,219
Botswana	15,292	6,275	4,163	2,402	61,960	2,478
Namibia	12,452	6,091	2,737	2,066	39,883	1,595
South Africa	403,891	244,631	77,747	88,699	989,282	39,571
Rest of South African Cust. Uni.	6,633	4,016	683	968	30,820	1,233
Rest of the World	182	102	46	33	651	26