Chapter 20

Behavioral Parameters

Betina V. Dimaranan, Robert A. McDougall, and Thomas W. Hertel

This chapter describes how we obtained the initial estimates for the Global Trade Analysis Project (GTAP) behavioral parameters file. These include the source substitution or *Armington* elasticities, the factor substitution elasticities, the factor transformation elasticities, the investment parameters, and the consumer demand elasticities. Table 20.1 summarizes for these parameters: the associated notation, the set over which they are indexed, and their description. In this chapter we explain the role of each parameter in the GTAP model, and describe how we obtained the current settings.

Most of the parameters treated here enter directly into the GTAP data base. In contrast with the rest of the data file where an extensive and elaborate process of transformation is required to remove any inconsistencies, and repair the omissions in the initial data sets, no such processing is required here for most of the behavioral parameters. For the most part, each individual parameter is an independent datum, which stands or falls on its own, and does not require any consistency checks with other parameters. The one exception to this rule is the consumer demand parameters (see section 20.5). Here we do need to check for consistency conditions — the triad of Engel aggregation, Cournot aggregation and symmetry condition. Also, there is a need to transform the data, from elasticities, for which we find empirical estimates, to the invariant parameters needed for our preferred functional form for the consumer demand system.

Table 20.1 Behavioral Parameters in the GTAP Model

	Parameters	Set Index	Description
σ_D	ESUBD(i)	i∈ TRAD_COMM	Elasticity of substitution between domestic and imported goods in the Armington aggregation structure for all agents in all regions
σ_M	ESUBM(i)	i∈ TRAD_COMM	Elasticity of substitution among imports from different destinations in the Armington aggregation structure of all agents in all regions
σ_{VA}	ESUBVA(j)	j∈ PROD_COMM	Elasticity of substitution between primary factors in the production of commodity j
	ESUBT(j)	j∈ PROD_COMM	Elasticity of substitution between composite intermediate inputs and value-added in the production of commodity j
σ_T	ETRAE(i)	i∈ ENDWS_COMM	Elasticity of transformation for sluggish primary factor endowments.
	SLUG		Sluggish-mobile switch parameter
	RORFLEX(r)	r∈ REG	Flexibility of expected net rate of return of capital stock in region r, with respect to investment
	RORDELTA		Binary switch coefficient which determines the mechanism of allocating investment funds across regions.
β	SUBPAR(i,r)	i∈ TRAD_COMM r∈ REG	The substitution parameter in the CDE minimum expenditure function
γ	INCPAR(i,r)	i∈ TRAD_COMM r∈ REG	The expansion parameter in the CDE minimum expenditure function

20.1 Source Substitution Elasticities

The data base contains two sets of source substitution elasticities. One relates to the substitution between domestic products and imports, and the other to the substitution between imports from different regions. To define these parameters precisely, we need to refer to the theoretical structure of the GTAP model. In that model, the source substitution elasticities are defined separately for each of the representative agents within each region rather than referring to a single economy-wide demand behavior, as in the other models. This means that for each commodity within each region, the domestic-import mix is determined separately for each industry, and for each of the final demand categories, namely investment, household consumption, and government consumption. The sourcing

of imports is also determined separately for intermediate usage (for all industries together) and for each of the final demand category. Finally, for cross-regional behavior, the GTAP model assumes that for each commodity, all agents in all regions display the same substitution elasticity.

The source substitution elasticities for GTAP are taken from the SALTER model (Jomini *et al.* 1991). Since GTAP derives its original sectoral classification from SALTER, we can adopt the SALTER parameters with only minor remapping of the commodities. The settings adopted here are shown in the first and second columns of table 20.2. The SALTER settings represent a compromise between econometric evidence and prior belief. A search of the econometric literature indicated that these elasticities are relatively low. On prior belief, it is generally believed that the terms of trade effects of commercial policy changes are generally quite weak. Such weak terms of trade effects imply that the source substitution elasticities are relatively high. The SALTER settings adopted here, thus, represent a compromise: the elasticities are generally higher than that indicated by the econometric literature, but still low enough to generate significant terms of trade effects (Jomini *et al.* 1991).

An aspect of the SALTER compromise is a divergence between domestic-import and import-import substitution elasticities. The econometric evidence related mostly, though not entirely, to domestic-import substitution. On the other hand, the terms of trade effects depend largely on the import-import substitution elasticities (if these are high, then a given region can displace other regions in its export markets without greatly reducing its export prices). By setting the import-import substitution elasticities higher than the domestic-import substitution elasticities, one can reconcile the low domestic-import substitution elasticities with the weak terms of trade effects. After reviewing a fairly sparse literature on import-import substitution elasticities, the SALTER team concluded that these might plausibly be set at a level twice as high as the import-domestic elasticities.

In summary, the SALTER elasticities were set as follows: the domestic-import substitution elasticities were based on preferred estimates from the econometric literature with some upward adjustment. The import-import substitution elasticities were then set at twice the domestic-import substitution elasticities. This procedure has been brought over without change into GTAP (see table 20.2). However, it may be of interest to observe that in long-run projections applications, GTAP staff have commonly increased the standard settings of these parameters. This is based on Gehlhar's observation that increasing the trade elasticities improved the fit of the model to East Asian trade shares over the 1980's (Gehlhar, 1994).

20.2 Factor Substitution Elasticities

The nested CES production functions in the GTAP model are similar to those used in many other applied general equilibrium models. Primary factors of production are assumed to substitute for one another according to the constant elasticity of substitution, σ_{VA}, while composite value-added and intermediates are used in fixed proportions. The overall elasticity of substitution among primary factors determines the ability of the economy to alter its output mix in response to changes in relative prices, or changes in the endowments of these factors. These parameters also play an important role in determining the sectoral supply response in the presence of sector-specific and sluggish factors of production. For example, with the supply of agricultural land being fixed in the model, the ability to expand farm output can be directly linked to the ease of substitution between land and labor, and land and capital.

The third column of table 20.2 reports the assumed values for σ_{VA} for each of the GTAP sectors. Like the trade elasticities, these are taken from the SALTER parameter file (Jomini *et al.* 1991). They are based on a review of the international cross-section studies which estimated this parameter, for various industries, using data from a wide range of countries. Note the relatively small elasticity of substitution in primary production. In light of the discussion regarding the linkage between this parameter and the sectoral supply response in the face of sector-specific factors, we can infer that whenever sector-specific, or sluggish factors of production are present in these sectors, this will significantly constrain the supply response of the sectors. Finally, we note that the greatest degree of substitutability (1.68) arises in the trade and transport sectors.

Although composite value-added and composite intermediate inputs are used in fixed proportions in the standard GTAP model, a parameter specifying the elasticity of substitution (ESUBT) between composite intermediates and composite value-added has recently been introduced into the model. This modification allows the user to specify the elasticity of substitution at the top nest of the production structure. The default setting of the elasticity is zero for all commodities, hence the ratio of composite intermediate inputs and value-added used in production is fixed.

20.3 Factor Transformation Elasticities

The third class of behavioral parameters in GTAP describes the degree of primary factor mobility between the sectors. Within each region, the model distinguishes between primary factors that are perfectly mobile across productive sectors and those that are sluggish. In an experiment with sluggish factor endowments, it is important to find out *how much of a disparity in relative sectoral returns can be sustained over the simulation period.* This result is governed by the value of the elasticity of transformation, $\sigma_T < 0$. If σ_T is close to zero, then the allocation of factors across sectors

is nearly fixed, and therefore factor supply is unresponsive to changes in relative returns. As σ_T takes on larger negative values, then the supply of factors will become more and more responsive to relative returns [see equation (51) in table 2.14 of chapter 2 in Hertel and Tsigas (1997)]. In the limit, as $\sigma_T \rightarrow -\infty$, this factor is perfectly mobile and no differential return can be sustained over the time horizon envisioned in the simulation. In this case, the factor should be reclassified as a perfectly mobile factor.

In the default setting which is generated from a standard aggregation of the data base, skilled and unskilled labor and capital are treated as perfectly mobile, whereas natural resources and agricultural land are treated as sluggish factors of production. Since the agricultural land is used only in primary agricultural activities, the sluggishness of land is relevant only if the aggregation in question contains more than one farm sectors.

The binary parameter SLUG allows users to change the default setting and switch the specification of an endowment from sluggish to mobile by choosing a value of zero for mobile or one for sluggish in the parameter file.

20.4 Investment Flexibility Parameters

Investment flexibility parameters refer to the degree of flexibility of regional investment. In the GTAP model, if the user chooses to allow the allocation of global investment to regional economies to be responsive to region-specific rates of return on capital (parameter *RORDELTA* is 1), then the parameter *RORFLEX*(r) > 0 must be properly specified [equation (58) of table 2.15 in chapter 2 of Hertel and Tsigas (1997)]. The smaller the value of *RORFLEX*(r), the greater the responsiveness of international investment to a change in the rate of return in region r. Because *RORFLEX*(r) is indexed over regions, it is possible to have some regions where investment is quite sensitive to changing rates of return, and others where this is not.

20.5 Consumer Demand Elasticities

GTAP employs the constant difference of elasticities (CDE) functional form in the specification of private household demands. The CDE, introduced by Hanoch (1975), can be classified as somewhere between the nonhomothetic CES and more flexible functional forms. It is based on the assumption of implicit additivity and allows for a richer representation of income effects on the demand system. The CDE implicit expenditure function is given by:

$$\sum_{i \in TRAD} B(i,r) * UP(r)^{\beta(i,r)\gamma(i,r)} * [\, PP(i,r) / E(PP(r),UP(r))\,]^{\beta(i,r)} \equiv 1.$$

where E(.) represents the minimum expenditure required to attain a pre-specified level of private household utility, UP(r), given the vector of private household prices, PP(r). Individual prices are normalized using minimum expenditure and then raised to the power β(i,r) and combined in an additive form. The calibration problem involves choosing the values of the substitution parameter, β(i,r) or SUBPAR(i,r), to replicate the desired compensated, own-price elasticities of demand, then choosing the expansion parameters, γ(i,r) or INCPAR(i,r) to replicate the targeted income elasticities of demand. In sections 20.5.1 and 20.5.2, we document the sources and assumptions behind the estimates of the commodity and region-specific income and price elasticities of demand that are used as targets in the CDE calibration procedure (section 20.5.3).

We draw on the available estimates of income elasticities from cross-country demand studies for adaptation to the 57 sectors and 66 regions in GTAP 5. Cross-country demand studies are preferable over single country demand studies since they provide demand elasticity estimates which are consistent across countries in terms of data and estimation procedure used. These cross-country consumer demand studies typically carry the assumption of preference independence, and hence of additivity, in the utility function when specified in terms of broadly defined commodity groups. In adapting income elasticity estimates to the GTAP data base, we must allocate the estimates from the more aggregate commodity groupings in these demand studies to our more disaggregated commodity classification.

20.5.1 Income Elasticities of Demand

Two studies provide income elasticity estimates which have more adequate country and commodity coverage for use with the disaggregate GTAP sectors and region. These are the World Food Model of the Food and Agriculture Organization (FAO, 1993) and the cross-country demand study by Theil, Chung, and Seale (1989). The income elasticity estimates used in World Food Model (WFM) were themselves obtained from the literature, or estimated using simple econometric models. The WFM covers 147 countries and 13 agricultural commodity groups, namely: wheat, rice, maize, millet and sorghum, other coarse grains, total fats and oils, bovine/cattle, sheep and goat, pig, poultry, diary products excluding butter, and butter. The Theil, Chung and Seale study (TCS) used the 1980 consumption data for 51 countries from phase IV of the International Comparison Project (ICP). Assuming preference independence, consumption data was fitted to Working's model of consumption expenditures defined for 10 broad commodity aggregates. The commodity aggregates are food, beverages and tobacco, clothing and footwear, gross rent and fuel, house furnishings and operations, medical care, transport and communications, recreation, education, and others.

The income elasticity estimates for food and for the commodity aggregates are mapped with GTAP's 57 commodities. The income elasticity estimates for food were adapted mostly from the FAO World Food Model. The income elasticity estimates for non-food commodities were obtained from a mapping with the broad commodity aggregates in the TCS study. In adapting all of these estimates to GTAP, we used 0.10 as the lower bound for income elasticities because smaller values can cause calibration problems for the CDE function. For example, 0.10 is used as the income elasticity for rice for which a negative value is otherwise reported for some regions, e.g. Japan.

The 66 GTAP regions also had to be mapped with the countries covered by WFM and TCS to arrive at income elasticity estimates at the regional level. This was done by first expanding the data set to the 211 standard countries and then aggregating the data to the 66 single regions. Since "China" in the WFM covers both the People's Republic of China (PRC) and Taiwan and since China is not covered in the TCS study, the results of more recent econometric work which are separately based on either urban or rural household surveys was used in obtaining income elasticity estimates for the PRC. Income elasticity estimates for food commodities for urban households were obtained from Chern and Wang (1994) and for broad commodity aggregates from Zhi and Kinsey (1994). For the rural households, we adapted the income elasticities estimated by Fan, Wailes, and Cramer (1995) using a 2-stage LES-AIDS model on 5 broad commodity aggregates in the first stage and on disaggregate food commodities in the second stage. A mapping of the broad commodity aggregates to GTAP's 57 sectors was also required before getting the average of the urban household and rural household income elasticity estimates for GTAP's China region.

The matrix of income elasticity estimates for 57 commodities and 66 regions are used in the CDE calibration procedure described in section 20.5.3 and in generating estimates of the own-price elasticity of demand as described below.

20.5.2 Price Elasticities of Demand

The cross section studies mentioned above are not in a strong position to generate information on price elasticities of demand. Reliable price data can be difficult to obtain, and, as noted above, most of these studies simply assume additive preferences, which means that the price elasticities of demand are determined simply by the income elasticity in conjunction with a single substitution parameter. For this reason, we do not attempt to specify the price elasticities of demand for all of the commodities in all of the regions. Instead, we use the relationship for directly additive preferences proposed by Frisch (1959) and embodied in the Linear Expenditure System (LES). As discussed in Huff *et al.* (1997), the CDE is a more flexible functional form than the LES, and we could have used independent information on own-price demand elasticities in this calibration had it been available. In the future, we hope to supplement the elasticities file with cross-country studies of own-price responses. In addition, by using the CDE, GTAP modelers are given the flexibility to adjust

commodity-specific substitution effects to conform with outside information on own-price elasticities of demand for key commodities in any particular application.

Using the income elasticity estimates, the values for own-price elasticities of demand were computed following the procedure and formula outlined in Zeitsch et al. (1991):

$$\varepsilon_{ii} = -s_i \eta_i \left(1 + \frac{\eta_i}{\omega}\right) + \frac{\eta_i}{\omega},$$

where ε_{ii} is the uncompensated own-price elasticity of demand for commodity *i*; η_i is the income elasticity of demand for commodity *i*, s_i is the expenditure share of commodity *i*, and ω is the Frisch parameter, that is, minus the reciprocal of the marginal utility of income, or the money flexibility. The compensated own-price elasticities, v_{ii}, are then computed as:

$$v_{ii} = -\varepsilon_{ii} + s_i \eta_i$$

Using the above methods, we end up with estimates for income and compensated own-price elasticities of demand for 57 commodities and 66 regions that can be used as targets in the CDE calibration procedure.

20.5.3 CDE Calibration Procedure

The calibration problem involves choosing the values of the substitution parameter, $\beta(i,r)$ or SUBPAR(i,r), to replicate the desired compensated, own-price elasticities of demand, then choosing the expansion parameters, $\gamma(i,r)$ or INCPAR(i,r) to replicate the targeted income elasticities of demand. The calibration of the CDE parameters for GTAP 5 follows the procedure used in the GTAP 4 data base which is discussed more fully in Liu, et al. (1998). The procedure is a modification of Surry's (1997) approach which uses *maximum entrophy* to calibrate a non-homethetic CDE expenditure function with subsistence quantities for three goods. Surry's procedure was modified to accommodate a larger number of goods with widely varying budget shares. The income elasticities, expenditure shares, and uncompensated direct price elasticities serve as target inputs into the calibration program. Fuzzy constraints were introduced into the model to permit departures from the target elasticities and to provide room for mutually inconsistent target inputs. The two constraints in the form of income elasticities of demand and uncompensated direct price elasticities of demand, became, respectively:

$$\eta_i(\text{estimated}) = \eta_i + \text{diff1} = [\textstyle\sum^k(s_k e_k \alpha_k) + e_i(1-\alpha_i)] \,/\, [\sum^k(s_k e_k)] + (\alpha_i - \sum^k s_k \alpha_k), \text{ and}$$

$$\varepsilon_{ii}(\text{estimated}) = \varepsilon_{ii} + \text{diff2} = -v_{ii} + s_i\eta_i = s_i[2\alpha_i - \textstyle\sum^k s_k \alpha_k] - \alpha_i + s_i\eta_i .$$

Where η_i, s_i , e_i, α_i, v_{ii}, ε_{ii} are income elasticity, expenditure share, expansion parameter, substitution parameter, compensated own direct price elasticity, and uncompensated direct price elasticity, respectively, for commodity i. We have target values for η_i, s_i, and ε_{ii} as inputs while e_i and α_i are positive variables in the program.

Harsh penalties were imposed on the absolute values of *diff1* and *diff2* to ensure minimal departures from the target elasticities. The approach turned out to be quite robust with respect to these departures.

Since the inclusion of more commodities increases the possibility that the program will not converge, the commodities for which calibration was done was aggregated to broad commodity groups. Since the input (target) elasticities were compiled from studies on disaggregated food commodities as well as on broad commodity aggregates, aggregation of the commodities was achieved by mapping the 57 GTAP commodities back to the same broad aggregate commodities which are consistent with the original studies. Eleven commodity groupings were identified - grain products (grains), other food products (other food), meat and livestock products (meatlvstk), dairy products (dairy), beverages and tobacco (bev_tob), textiles and wearing apparel (textwapp), rent and fuel (rent_fuel), other commodities (others), transport, durables, and services. Table 20.3 shows the mapping between the 57 GTAP commodities and the 11 aggregated commodities. Tables 20.4 and 20.5 report the income and uncompensated own-price demand elasticity targets for all 57 regions and 11 commodities, respectively. After the estimation was done for the aggregated commodities, the CDE parameters for the aggregated system was then extended to the 57 commodity level by assuming that all in-group commodities have the same parameter estimates as their aggregated parents.

References

Chern, W. and G. Wang. 1994. “Angel Function and Complete Food Demand System for Chinese Urban Households,” *China Economic Review*. 5(Spring 1994):35-58.

Fan, S., E. Wails, and G. Cramer. 1995. “Household Demand in Rural China: A Two-Stage LES-AIDS Model,” American Journal of Agricultural Economics, 77(February 1995):54-62.

Food and Agriculture Organization. 1993. “World Food Model,” supplement to the FAO Agricultural Projections to 2000, Rome: FAO.

Frisch, R. 1959. "A Complete Scheme for Computing All Direct and Cross Elasticities in a Model with Many Sectors," *Econometrics* 27:177–196.

Gehlhar, M.J 1994. “Economic Growth and Trade in the Pacific Rim: An Analysis of Trade Patterns.” Unpublished Ph.D. Dissertation, Purdue University.

Hanoch, G. 1975. “Production and Demand Models with Direct and Indirect Implicit Additivity,” Econometrica. 43:395-419.

Hertel, T.H. (Editor). 1997. *Global Trade Analysis: Modeling and Applications*. Cambridge University Press.

Huff, K., K. Hanslow, T.W. Hertel, and M.E. Tsigas 1997. “GTAP Behavior Parameters,” in T.W. Hertel (ed), *Global Trade Analysis: Modeling and Applications*. Cambridge University Press.

Jomini, P., R. McDougall, G. Watts, and P.S. Dee. 1994. The SALTER Model of the World Economy: Model Stricture, Data Base and Parameters. Canberra, Australia: Industry Commission.

Jomini, P., J.F. Zeitsch, R. McDougall, A. Welsh, S. Brown, J.Hambley and J. Kelly. 1991. SALTER: A General Equilibrium Model of the World Economy, Vol. 1. Model Structure, Data Base, and Parameters. Canberra, Australia: Industry Commission.

Liu, J., Y. Surry, B. Dimaranan and T. Hertel. 1998. “CDE Calibration,” Chapter 21 in Robert McDougall, Aziz Elbehri, and Truong P. Truong. Global Trade, Assistance and Protection: The GTAP 4 Data Base, Center for Global Trade Analysis, Purdue University, West Lafayette, Indiana.

Lluch, C., A. Powell, and R. Williams. 1977. Patterns in Household Demand and Savings. New York: Oxford University Press.

Surry, Y. 1997. Applying and Generalizing the CDE and LES Demand Systems in CGE Models. Unpublished Paper. INRA Centre de Rennes, France.

Theil, H., C.F. Chung, and J.L. Seale, Jr. 1989. International Evidence on Consumption Patterns. Supplement 1 to Advances in Econometrics. Greenwich, CT: JAI Press.

Theil, H. and K.W. Clements. 1987. Applied Demand Analysis: Results from System-Wide Approaches. Cambridge, MA: Ballinger Publishing Company.

Zhi, W. and J. Kinsey. 1994. “Consumption and Saving Behavior under Strict and Partial Rationing,” China Economic Review, 5 (Spring 1994):83-100.

Zeitsch, J., R. McDougall, P. Jomini, A. Welsh, J. Hambley, S. Brown, and J. Kelly. 1991. “SALTER: A General Equilibrium Model of the World Economy.” SALTER Working Paper N. 4. Canberra, Australia: Industry Commission.

Table 20.2 GTAP Substitution Elasticities

GTAP Commodities	Domestic/ Imported (σ_D)	Sourcing of Imports (σ_M)	Value-added (σ_{VA})
Paddy rice	2.20	4.40	0.24
Wheat	2.20	4.40	0.24
Cereal grains n.e.c.	2.20	4.40	0.24
Vegetables, fruit, nuts	2.20	4.40	0.24
Oil seeds	2.20	4.40	0.24
Sugar cane, sugar beet	2.20	4.40	0.24
Plant-based fibers	2.20	4.40	0.24
Crops n.e.c.	2.20	4.40	0.24
Cattle, sheep and goats, horses	2.80	5.60	0.24
Animal products n.e.c.	2.80	5.60	0.24
Raw milk	2.20	4.40	0.24
Wool, silk-worm cocoons	2.20	4.40	0.24
Forestry	2.80	5.60	0.20
Fishing	2.80	5.60	0.20
Coal	2.80	5.60	0.20
Oil	2.80	5.60	0.20
Gas	2.80	5.60	0.20
Minerals n.e.c.	2.80	5.60	0.20
Cattle, sheep and goat, horse meat	2.20	4.40	1.12
Meat Products n.e.c.	2.20	4.40	1.12
Vegetable oils and fats	2.20	4.40	1.12
Dairy products	2.20	4.40	1.12
Processed rice	2.20	4.40	1.12
Sugar	2.20	4.40	1.12
Food products n.e.c.	2.20	4.40	1.12
Beverages and tobacco products	3.10	6.20	1.12
Textiles	2.20	4.40	1.26
Wearing apparel	4.40	8.80	1.26
Leather products	4.40	8.80	1.26
Wood products	2.80	5.60	1.26
Paper products, publishing	1.80	3.60	1.26
Petroleum, coal products	1.90	3.80	1.26
Chemicals, rubber, plastic products	1.90	3.80	1.26
Mineral products n.e.c.	2.80	5.60	1.26
Ferrous Metals	2.80	5.60	1.26
Metals n.e.c.	2.80	5.60	1.26
Metal products	2.80	5.60	1.26

Contd

Table 20.2 GTAP Substitution Elasticities (Continued)

GTAP Commodities	Domestic/ Imported (σ_D)	Sourcing of Imports (σ_M)	Value-added (σ_{VA})
Motor vehicles and parts	5.20	10.40	1.26
Transport equipment n.e.c.	5.20	10.40	1.26
Electronic equipment	2.80	5.60	1.26
Machinery and equipment n.e.c.	2.80	5.60	1.26
Manufacture n.e.c.	2.80	5.60	1.26
Electricity	2.80	5.60	1.26
Gas manufacture, distribution	2.80	5.60	1.26
Water	2.80	5.60	1.26
Construction	1.90	3.80	1.40
Trade	1.90	3.80	1.68
Transport n.e.c.	1.90	3.80	1.68
Water transport	1.90	3.80	1.68
Air transport	1.90	3.80	1.68
Communication	1.90	3.80	1.26
Financial services n.e.c.	1.90	3.80	1.26
Insurance	1.90	3.80	1.26
Business services n.e.c.	1.90	3.80	1.26
Recreational and other services	1.90	3.80	1.26
Public admin and defense, education, health	1.90	3.80	1.26
Dwellings	1.90	3.80	1.26

Source: Adapted from Jomini *et al.*, table 4.3, 1991.

Table 20.3 Mapping of GTAP Commodities with 11 Commodity Aggregates

GTAP Sectors	Aggregated Commodities	GTAP Sectors	Aggregated Commodities
pdr	grains	lum	other
wht	grains	ppp	other
gro	grains	p_c	other
v_f	otherfood	crp	other
osd	otherfood	nmm	other
c_b	otherfood	i_s	other
pfb	otherfood	nfm	other
ocr	otherfood	fmp	other
ctl	meatlvstk	mvh	transport
oap	meatlvstk	otn	transport
rmk	dairy	ele	durables
wol	textwapp	ome	durables
for	other	omf	durables
fsh	otherfood	ely	rent_fuel
col	rent_fuel	gdt	rent_fuel
oil	rent_fuel	wtr	rent_fuel
gas	rent_fuel	cns	rent_fuel
omn	other	trd	transport
cmt	meatlvstk	otp	transport
omt	meatlvstk	wtp	transport
vol	otherfood	atp	transport
mil	dairy	cmn	service
pcr	grains	ofi	service
sgr	otherfood	isr	service
ofd	otherfood	obs	service
b_t	bev_tob	ros	service
tex	textwapp	osg	service
wap	textwapp	dwe	rent_fuel
lea	other		

Table 20.4 Target Income Elasticities of Demand

Regions	Grains	Other Food	Meatlvstk	Dairy	Bev_Tob	TextWApp	Rest_ Fuel	Other	Transport	Durables	Services
AUS	0.14	0.14	0.17	0.09	0.92	0.87	1.01	1.13	1.12	1.05	1.13
NZL	0.09	0.41	0.09	0.09	0.88	0.83	0.98	1.12	1.11	1.03	1.14
CHN	0.41	0.87	1.12	0.77	0.96	0.92	1.26	1.17	1.09	1.34	1.05
HKG	0.18	0.35	0.33	0.48	0.92	0.87	1.02	1.15	1.14	1.06	1.17
JPN	0.09	0.34	0.49	0.54	0.89	0.84	0.99	1.12	1.11	1.03	1.13
KOR	0.17	0.55	0.46	0.65	0.87	0.82	0.98	1.19	1.17	1.04	1.21
TWN	0.09	0.44	0.48	0.22	0.86	0.81	0.96	1.11	1.10	1.00	1.13
IDN	0.40	0.65	0.77	1.06	0.88	0.83	1.01	1.37	1.34	1.10	1.44
MYS	0.18	0.60	0.32	0.36	0.93	0.87	1.04	1.20	1.19	1.08	1.22
PHL	0.19	0.64	0.54	0.50	0.96	0.91	1.08	1.34	1.33	1.16	1.39
SGP	0.27	0.18	0.49	0.39	0.93	0.88	1.02	1.14	1.13	1.06	1.15
THA	0.08	0.57	0.35	0.48	0.86	0.81	0.97	1.17	1.15	1.02	1.19
VNM	0.33	0.65	0.96	0.81	0.84	0.79	0.97	1.43	1.38	1.06	1.51
BGD	0.27	0.73	0.78	0.73	0.99	0.93	1.12	1.47	1.44	1.21	1.53
IND	0.29	0.68	0.64	0.58	0.86	0.81	1.00	1.59	1.51	1.10	1.69
LKA	0.39	0.67	0.95	0.65	0.99	0.94	1.13	1.45	1.42	1.21	1.52
XSA	0.33	0.75	0.81	0.64	0.98	0.93	1.12	1.47	1.44	1.21	1.50
CAN	0.13	0.14	0.25	0.09	0.92	0.86	1.01	1.13	1.12	1.04	1.13
USA	0.25	0.37	0.36	0.31	0.76	0.71	0.85	1.08	1.05	0.90	1.11
MEX	0.09	0.55	0.40	0.43	0.88	0.83	1.00	1.20	1.19	1.06	1.23
XCM	0.36	0.58	0.53	0.46	0.90	0.85	1.02	1.26	1.24	1.08	1.29
COL	0.54	0.60	0.54	0.37	0.95	0.90	1.06	1.28	1.26	1.13	1.29
PER	0.21	0.58	0.57	0.56	0.89	0.84	1.01	1.21	1.20	1.06	1.24
VEN	0.14	0.48	0.33	0.30	0.91	0.85	1.01	1.16	1.15	1.06	1.18
XAP	0.29	0.59	0.63	0.47	0.86	0.81	0.98	1.21	1.19	1.04	1.24
ARG	0.09	0.50	0.16	0.13	0.92	0.87	1.03	1.21	1.19	1.09	1.23
BRA	0.19	0.52	0.49	0.40	0.94	0.89	1.06	1.22	1.21	1.10	1.24
CHL	0.20	0.52	0.50	0.41	0.94	0.89	1.05	1.24	1.23	1.11	1.26
URY	0.18	0.50	0.19	0.13	0.98	0.92	1.09	1.25	1.24	1.14	1.27
XSM	0.27	0.60	0.45	0.42	0.86	0.81	0.98	1.22	1.20	1.04	1.25
AUT	0.26	0.27	0.13	0.08	0.89	0.84	0.99	1.10	1.10	1.02	1.12
BEL	0.18	0.23	0.30	0.09	0.92	0.87	1.01	1.13	1.13	1.06	1.15
DNK	0.26	0.23	0.32	0.09	0.92	0.87	1.01	1.14	1.13	1.06	1.15
FIN	0.21	0.36	0.20	0.09	0.94	0.88	1.04	1.17	1.17	1.08	1.19
FRA	0.30	0.42	0.43	0.34	0.80	0.76	0.90	1.15	1.12	0.96	1.22
DEU	0.17	0.22	0.28	0.09	0.90	0.85	0.99	1.11	1.10	1.03	1.12
GBR	0.09	0.29	0.20	0.09	0.90	0.85	1.00	1.12	1.12	1.04	1.13
GRC	0.12	0.52	0.37	0.46	1.03	0.97	1.15	1.32	1.31	1.20	1.35

Contd

Table 20.4 Target Income Elasticities of Demand (Continued)

Regions	Grains	Other Food	Meatlvstk	Dairy	Bev_Tob	TextWApp	Rest_ Fuel	Other	Transport	Durables	Services
IRL	0.29	0.44	0.34	0.09	0.89	0.83	0.98	1.13	1.12	1.03	1.15
ITA	0.17	0.29	0.28	0.28	0.89	0.83	0.98	1.10	1.09	1.02	1.12
LUX	0.18	0.22	0.30	0.09	0.93	0.87	1.02	1.14	1.13	1.06	1.15
NLD	0.17	0.24	0.17	0.09	0.89	0.84	0.98	1.11	1.10	1.03	1.11
PRT	0.18	0.51	0.49	0.65	0.93	0.87	1.03	1.20	1.19	1.08	1.22
ESP	0.09	0.39	0.51	0.23	0.89	0.84	0.99	1.13	1.12	1.03	1.12
SWE	0.23	0.25	0.11	0.09	0.90	0.85	0.99	1.11	1.10	1.03	1.13
CHE	0.09	0.30	0.22	0.09	0.91	0.85	1.00	1.13	1.12	1.04	1.14
XEF	0.26	0.30	0.18	0.09	0.90	0.85	1.00	1.12	1.11	1.03	1.13
HUN	0.16	0.46	0.51	0.39	0.86	0.81	0.96	1.11	1.10	1.00	1.12
POL	0.09	0.54	0.50	0.28	0.91	0.86	1.02	1.18	1.18	1.07	1.20
XCE	0.16	0.55	0.46	0.40	1.00	0.94	1.12	1.30	1.29	1.18	1.32
XSU	0.19	0.53	0.24	0.26	0.81	0.76	0.92	1.15	1.14	0.98	1.19
TUR	0.12	0.56	0.60	0.47	0.94	0.89	1.05	1.24	1.23	1.11	1.27
XME	0.35	0.51	0.60	0.48	0.87	0.82	0.97	1.18	1.17	1.03	1.21
MAR	0.17	0.68	0.69	0.62	0.95	0.89	1.08	1.42	1.41	1.16	1.41
XNF	0.22	0.67	0.67	0.54	1.02	0.96	1.15	1.42	1.40	1.23	1.41
BWA	0.32	0.56	0.96	0.73	0.79	0.75	0.91	1.20	1.15	0.98	1.25
XSC	0.45	0.57	0.62	0.65	0.78	0.73	0.90	1.19	1.13	0.96	1.23
MWI	0.22	0.58	0.56	0.69	0.76	0.71	0.89	1.55	1.46	0.99	1.87
MOZ	0.34	0.57	0.62	0.39	0.74	0.70	0.87	1.50	1.43	0.97	1.79
TZA	0.31	0.67	0.68	0.64	0.86	0.81	1.02	2.11	1.91	1.15	2.45
ZMB	0.20	0.61	0.49	0.59	0.78	0.73	0.92	1.59	1.50	1.02	1.87
ZWE	0.26	0.53	0.47	0.32	0.67	0.63	0.79	1.37	1.29	0.88	1.52
XSF	0.32	0.59	0.59	0.47	0.76	0.71	0.88	1.48	1.40	0.98	1.66
UGA	0.35	0.67	0.74	0.54	0.92	0.86	1.07	1.72	1.63	1.18	1.82
XSS	0.58	0.58	0.61	0.48	0.77	0.72	0.89	1.41	1.34	0.98	1.60
XRW	0.33	0.54	0.53	0.48	0.87	0.82	0.98	1.24	1.22	1.04	1.29

Table 20.5 Target Uncompensated Own-Price Elasticities of Demand

Regions	Grains	Other Food	Meatlvstk	Dairy	Bev_Tob	TextWApp	Rest_Fuel	Other	Transport	Durables	Services
AUS	-0.09	-0.10	-0.12	-0.06	-0.60	-0.59	-0.56	-0.76	-0.57	-0.71	-0.71
NZL	-0.06	-0.27	-0.06	-0.06	-0.56	-0.54	-0.53	-0.73	-0.59	-0.67	-0.70
CHN	-0.08	-0.16	-0.20	-0.16	-0.18	-0.18	-0.25	-0.23	-0.20	-0.26	-0.21
HKG	-0.14	-0.25	-0.24	-0.35	-0.67	-0.59	-0.71	-0.83	-0.64	-0.72	-0.84
JPN	-0.07	-0.28	-0.40	-0.45	-0.71	-0.68	-0.65	-0.91	-0.68	-0.83	-0.87
KOR	-0.09	-0.29	-0.25	-0.35	-0.45	-0.43	-0.47	-0.63	-0.56	-0.55	-0.60
TWN	-0.05	-0.26	-0.29	-0.13	-0.51	-0.48	-0.58	-0.67	-0.56	-0.60	-0.58
IDN	-0.09	-0.15	-0.18	-0.26	-0.20	-0.20	-0.23	-0.32	-0.26	-0.26	-0.33
MYS	-0.07	-0.23	-0.12	-0.14	-0.34	-0.33	-0.38	-0.44	-0.40	-0.37	-0.46
PHL	-0.04	-0.14	-0.12	-0.11	-0.20	-0.20	-0.23	-0.29	-0.25	-0.25	-0.30
SGP	-0.21	-0.14	-0.37	-0.30	-0.69	-0.65	-0.77	-0.86	-0.69	-0.72	-0.85
THA	-0.03	-0.19	-0.12	-0.16	-0.28	-0.26	-0.32	-0.37	-0.33	-0.34	-0.39
VNM	-0.05	-0.11	-0.15	-0.13	-0.13	-0.13	-0.09	-0.23	-0.22	-0.17	-0.24
BGD	-0.04	-0.10	-0.11	-0.10	-0.14	-0.13	-0.15	-0.20	-0.19	-0.17	-0.19
IND	-0.05	-0.12	-0.11	-0.10	-0.15	-0.14	-0.17	-0.27	-0.23	-0.19	-0.29
LKA	-0.07	-0.12	-0.18	-0.13	-0.19	-0.17	-0.22	-0.28	-0.23	-0.23	-0.29
XSA	-0.05	-0.12	-0.13	-0.10	-0.16	-0.14	-0.17	-0.23	-0.21	-0.19	-0.23
CAN	-0.09	-0.09	-0.17	-0.06	-0.61	-0.57	-0.55	-0.74	-0.62	-0.69	-0.73
USA	-0.23	-0.34	-0.34	-0.29	-0.70	-0.66	-0.71	-0.99	-0.76	-0.84	-0.87
MEX	-0.04	-0.21	-0.16	-0.17	-0.34	-0.32	-0.39	-0.46	-0.36	-0.41	-0.46
XCM	-0.10	-0.16	-0.14	-0.12	-0.24	-0.22	-0.27	-0.34	-0.30	-0.29	-0.34
COL	-0.16	-0.17	-0.16	-0.11	-0.27	-0.26	-0.28	-0.37	-0.35	-0.33	-0.36
PER	-0.07	-0.19	-0.19	-0.18	-0.28	-0.26	-0.33	-0.38	-0.34	-0.34	-0.38
VEN	-0.05	-0.18	-0.12	-0.11	-0.32	-0.31	-0.37	-0.42	-0.34	-0.39	-0.40
XAP	-0.08	-0.16	-0.17	-0.13	-0.23	-0.21	-0.26	-0.32	-0.28	-0.28	-0.31
ARG	-0.05	-0.24	-0.08	-0.06	-0.44	-0.42	-0.51	-0.57	-0.54	-0.54	-0.55
BRA	-0.07	-0.20	-0.19	-0.16	-0.36	-0.33	-0.39	-0.46	-0.40	-0.42	-0.46
CHL	-0.08	-0.20	-0.20	-0.16	-0.36	-0.34	-0.38	-0.48	-0.41	-0.44	-0.49
URY	-0.07	-0.20	-0.08	-0.05	-0.37	-0.37	-0.36	-0.50	-0.44	-0.46	-0.49
XSM	-0.08	-0.17	-0.13	-0.12	-0.23	-0.24	-0.26	-0.35	-0.30	-0.30	-0.35
AUT	-0.19	-0.20	-0.10	-0.06	-0.66	-0.62	-0.73	-0.81	-0.66	-0.75	-0.64
BEL	-0.13	-0.16	-0.21	-0.06	-0.64	-0.60	-0.62	-0.79	-0.68	-0.74	-0.75
DNK	-0.20	-0.18	-0.25	-0.07	-0.70	-0.67	-0.56	-0.87	-0.73	-0.82	-0.85
FIN	-0.15	-0.25	-0.14	-0.06	-0.64	-0.60	-0.53	-0.79	-0.61	-0.74	-0.79
FRA	-0.24	-0.33	-0.34	-0.27	-0.64	-0.60	-0.63	-0.88	-0.77	-0.76	-0.75
DEU	-0.13	-0.16	-0.21	-0.07	-0.65	-0.62	-0.73	-0.80	-0.68	-0.76	-0.69
GBR	-0.06	-0.20	-0.14	-0.06	-0.63	-0.59	-0.63	-0.77	-0.54	-0.71	-0.76
GRC	-0.06	-0.23	-0.18	-0.22	-0.49	-0.45	-0.53	-0.62	-0.56	-0.57	-0.57

Contd

Table 20.5 Target Uncompensated Own-Price Elasticities of Demand (Continued)

Regions	Grains	Other Food	Meatlvstk	Dairy	Bev_Tob	TextWApp	Rest_Fuel	Other	Transport	Durables	Services
IRL	-0.20	-0.30	-0.23	-0.06	-0.60	-0.57	-0.64	-0.76	-0.67	-0.71	-0.69
ITA	-0.12	-0.20	-0.19	-0.19	-0.60	-0.56	-0.67	-0.74	-0.59	-0.69	-0.59
LUX	-0.13	-0.16	-0.22	-0.07	-0.66	-0.61	-0.63	-0.77	-0.70	-0.75	-0.76
NLD	-0.13	-0.18	-0.12	-0.06	-0.63	-0.60	-0.60	-0.78	-0.60	-0.73	-0.70
PRT	-0.09	-0.26	-0.25	-0.33	-0.47	-0.44	-0.52	-0.60	-0.54	-0.55	-0.55
ESP	-0.05	-0.23	-0.30	-0.13	-0.52	-0.49	-0.54	-0.65	-0.40	-0.59	-0.61
SWE	-0.17	-0.19	-0.09	-0.07	-0.66	-0.62	-0.71	-0.80	-0.68	-0.76	-0.56
CHE	-0.07	-0.25	-0.18	-0.07	-0.72	-0.69	-0.74	-0.91	-0.72	-0.83	-0.86
XEF	-0.21	-0.24	-0.15	-0.07	-0.72	-0.69	-0.74	-0.90	-0.72	-0.84	-0.85
HUN	-0.06	-0.19	-0.21	-0.16	-0.35	-0.33	-0.39	-0.44	-0.37	-0.41	-0.41
POL	-0.03	-0.19	-0.18	-0.10	-0.30	-0.30	-0.36	-0.41	-0.32	-0.38	-0.41
XCE	-0.05	-0.16	-0.14	-0.12	-0.28	-0.27	-0.33	-0.38	-0.35	-0.34	-0.38
XSU	-0.06	-0.17	-0.08	-0.09	-0.26	-0.25	-0.29	-0.37	-0.32	-0.32	-0.36
TUR	-0.04	-0.18	-0.20	-0.15	-0.30	-0.29	-0.33	-0.39	-0.31	-0.36	-0.41
XME	-0.13	-0.19	-0.22	-0.18	-0.31	-0.30	-0.33	-0.43	-0.37	-0.38	-0.42
MAR	-0.04	-0.15	-0.16	-0.15	-0.22	-0.20	-0.24	-0.32	-0.30	-0.27	-0.26
XNF	-0.05	-0.16	-0.16	-0.13	-0.25	-0.23	-0.27	-0.34	-0.31	-0.30	-0.27
BWA	-0.13	-0.22	-0.36	-0.29	-0.30	-0.30	-0.36	-0.48	-0.42	-0.40	-0.47
XSC	-0.18	-0.22	-0.24	-0.25	-0.29	-0.28	-0.33	-0.45	-0.31	-0.37	-0.46
MWI	-0.04	-0.09	-0.09	-0.11	-0.11	-0.12	-0.14	-0.23	-0.16	-0.16	-0.28
MOZ	-0.05	-0.09	-0.10	-0.06	-0.12	-0.11	-0.14	-0.23	-0.13	-0.16	-0.28
TZA	-0.04	-0.09	-0.09	-0.09	-0.11	-0.11	-0.14	-0.28	-0.22	-0.16	-0.34
ZMB	-0.04	-0.11	-0.10	-0.11	-0.14	-0.14	-0.18	-0.29	-0.25	-0.20	-0.34
ZWE	-0.07	-0.14	-0.13	-0.09	-0.16	-0.17	-0.21	-0.37	-0.31	-0.24	-0.37
XSF	-0.08	-0.15	-0.15	-0.12	-0.18	-0.18	-0.23	-0.38	-0.32	-0.26	-0.41
UGA	-0.05	-0.08	-0.11	-0.08	-0.13	-0.13	-0.15	-0.25	-0.20	-0.17	-0.24
XSS	-0.10	-0.10	-0.11	-0.09	-0.13	-0.13	-0.15	-0.25	-0.21	-0.18	-0.26
XRW	-0.10	-0.16	-0.16	-0.15	-0.25	-0.24	-0.29	-0.37	-0.29	-0.31	-0.37