Volume Title: Foreign Trade Regimes and Economic Development: India

Volume Author/Editor: Jagdish N. Bhagwati and T. N. Srinivasan

Volume Publisher: NBER

Volume ISBN: 0-87014-531-2

Volume URL: http://www.nber.org/books/bhag75-1

Publication Date: 1975

Chapter Title: Export Policy and Economic Performance

Chapter Author: Jagdish N. Bhagwati, T. N. Srinivasan, Kirit Parikh

Chapter URL: http://www.nber.org/chapters/c4521

Chapter pages in book: (p. 197 - 211)

Chapter 14

Export Policy and Economic Performance

As noted in Chapter 12, we can analyze the interaction between exports and economic performance in two different ways: (1) by assuming that the efficiency and choice of techniques, the available resources and knowhow are given and that the effect of improved export performance can essentially be captured in a planning-model framework by reworking the model with a revised export vector; and (2) by trying to examine whether an improved export performance could have led to larger savings, more technical progress, improved aid inflow and other benefits.

On the latter set of alleged, beneficial effects of improved export performance, our analysis has failed to turn up anything very convincing. In Chapter 15, we will note that the overall productivity change in the mainly exporting industries does not appear to be significantly higher than in the mainly importing industries; nor is there evidence that those firms that now engage in research and development are *either* export-oriented relative to those that do not *or* directing their research and development to better designing for export markets instead of directing it to processes for using locally available inputs. Nor is there evidence, as we will note in Chapter 16, that the mainly exporting industries save more than the mainly importing industries.[1]

On the other hand, the former approach does lead to positive and strong indications that an improved export performance would have promoted improved economic performance. We proceed to demonstrate this now, by exploring the implications of an improved export performance (already argued to be feasible) on long-term growth by undertaking a simulation exercise, using the Eckaus-Parikh planning model for the Indian economy.[2]

It should be emphasized at the outset that this exercise, based on the Eckaus-Parikh model, is no more than illustrative for a number of reasons, the more important of which are noted below.

1. The model (in the Guidepath I version we use) has no constraint relating savings to income generation except through the mild requirement that aggregate consumption in each period lies above a geometrically growing floor. Because of this, and the postulated high exponential growth rates subsequent to the planning period, the model results in a strikingly high marginal ratio of savings to GNP. An additional consequence is that the GNP growth over a fifteen-year horizon in the reference and simulation runs exceeds 10 percent annually, a rate considerably exceeding the actual performance managed by the Indian economy in recent years.

2. The fact that the data of the model, particularly the input and capital coefficients, are not only dated (in relation to estimates which may be made now) but that some of the capital coefficients have turned out to be very optimistic compared with experience (especially in agriculture), also accounts for the high growth rates of GNP turned up in the exercises with the model which exceed the actual performance of the Indian economy.

3. The aggregation in the model, resulting in only eleven sectors for the economy, also makes it impossible to draw comparative advantage implications meaningfully from the model. Thus, as will be noted below, we postulate a hypothetical, and very modest, increase in exports which is centered heavily on sectors other than agriculture, food and clothing. (However, even such a policy, more in keeping with the notions of the planners about the composition and feasibility of India's export performance, is then shown to be productive of a better economic performance.)

On balance, we still consider the present exercise to be instructive in its illustration of the growth potentiality of additional exports (in the manner precisely set out at the outset of this chapter), simply because any unhappy features of the model will affect both the simulation and the reference runs; and there seems to us to be no clear presumption that the *difference* between the two runs, attributable to the change in the export vector, will be significantly affected. We should also note, to avoid unnecessary confusion, that the Eckaus-Parikh model is a *planning* model and *not* an econometric (behavioral-predictive) model, so that the reader should not be surprised by discrepancies between the model's simulation runs and actual developments in the Indian economy.

The Eckaus-Parikh model is an intertemporal optimizing model, in which the economy is aggregated into 11 sectors. Further:

1. *The objective or criterion function,* which is maximized, is the sum of aggregate consumption in each of the plan periods, discounted by a social discount rate. The solution of each model achieves the highest value of this function that is consistent with all the constraints. This

particular objective is chosen because it reflects directly, through comparison with population levels, one of the major objectives of development: improvement in the average standard of living. Other types of criteria, such as maximizing the growth of the industrial sector or expanding agricultural production as fast as possible, prejudge the means by which social welfare is advanced. It should be noted, however, that in a programming model, goals of economic policy can be stipulated not only by what is chosen to be maximized, but also by the content of the constraints.

2. *A consumption growth constraint* requires that aggregate consumption grow by at least a stipulated minimum rate. This rate, when compared to the population growth rate, indicates a required minimum rate of growth in the average standard of living.
3. *A savings constraint*, imposed in some of the models, relates the maximum permissible level of net savings to the net national product. It is yet another way of introducing social goals and a behavioral constraint into the models, for it describes, though indirectly, the limits on the willingness of society to sacrifice present for future consumption.
4. *Consumption proportions* are specified exogenously for each period in some models but are varied endogenously from period to period by means of consumption-expenditure elasticities in other models.
5. *Production accounting relationships* stipulate that the total requirements for each commodity in each period not exceed its availability in that period. The total demand consists of the requirements for the good as an intermediate input, which are determined by use of an input-output matrix, and of a number of final demands. These include the demands for inventories, new fixed investment, replacement investment, public and private consumption, and exports. The availability is the sum of domestic production and imports.
6. *Capacity restraints* insure by means of capital-output ratios that the output of each sector in each period does not exceed that producible with the fixed capacity available in the sector at the beginning of that period.
7. Capital accounting relationships determine capacity at the beginning of each period as the capacity previously available, less depreciation, plus the newly completed additions to capacity, plus that part of the depreciated capacity which is restored.
8. *New capital creation* takes place in each sector with a separate gestation lag for the contribution from each of the capital goods producing sectors. The different gestation lags for each sector are specified externally to the model.
9. *Inventory requirements* are determined by inventory-output matrices.
10. *Exports and public consumption* are estimated outside the model and supplied to it as data.
11. *Imports* are divided into two categories. "Noncompetitive" imports for each sector are determined by stipulated import-output ratios, but

the stipulations may change over time. "Competitive" imports are allocated by the model with limits set, in some versions, on the extent to which this type of import can be absorbed in any one sector.

12. *Balance of payments constraints* require that total imports in each period not exceed the foreign exchange availability as determined by exports and the stipulated net foreign capital inflow in that period. A goal of national self-sufficiency can also be imposed in this constraint through the time pattern stipulated for the decline and eventual elimination of the net foreign capital inflow.
13. *Initial conditions* are estimates of production capacities, stocks of inventories, and the unfinished capital-in-process actually available at the beginning of the plan period.
14. *Terminal conditions* must be provided in some manner, in order to relate the events of the plan period to the postplan period, so the model will not behave as if time stopped at the end of the plan. These terminal conditions are the final capital stocks on hand and in process of completion. They are either completely specified from some source outside the model, or they are partially derived in the solution of the model.[3]

The algebraic specification of the model is given in the Appendix to this chapter.

Among the various models considered by Eckaus and Parikh, we chose their long-term model, called *Guidepath Model I.* In this model, the time span is stretched to eighteen years, aggregated into six periods of three years each. Such aggregation was necessary to stay within the bounds of computational capacity. The terminal conditions of this model are determined by specifying that in the post-terminal periods, the growth rate of various elements of final demand such as consumption, government expenditure, exports, capital replacement requirement, and imports must exceed specified minimum levels. In the Guidepath Model I, the savings constraint referred to above was not imposed. Also, a process of modernization of the agricultural sector was built into the model, the details of which are not of interest in the present context.

The eighteen years covered were from 1966 to 1984; and the six periods were 1966–69, 1969–72, . . . , 1981–84. Of the eleven sectors of the model, four sectors (electricity, transportation, construction and housing) produced non-traded goods. Of the seven trading sectors, agriculture and plantations and, to a certain extent, food and clothing produced traditional exportables. It was decided that there was no point in postulating additional exports from these sectors. Thus the exports of the trading sectors were augmented in the simulation (compared to the reference run) as shown in Table 14–1.

Thus, in the simulation run, total exports in the final period were higher than in the reference run by about 6 percent.[4] Of course, the increase in exports of non-traditional sectors was considerably higher than 6 percent.

TABLE 14–1

Exports in Reference and Simulation Runs

(Rs. millions, 1959–60 prices)

Sector	3-yr. totals, 1966–67/1968–69			3-yr. totals, 1981–82/1983–84		
	Reference	Simulation	Difference	Reference	Simulation	Difference
1. Agriculture and plantations	6,961	6,961	0.00	12,367	12,367	0.00
2. Mining and metals	3,838	4,018	180	17,052	18,132	1,080
3. Equipment	1,833	2,193	360	10,657	12,817	2,160
4. Chemicals	647	782	135	7,251	8,061	810
5. Cement and non-metals	75	165	90	1,767	2,307	540
6. Food, clothing and leather	13,376	13,421	45	22,403	22,673	270
7. Electricity	—	—	—	—	—	—
8. Transport	—	—	—	—	—	—
9. Construction	—	—	—	—	—	—
10. Housing	—	—	—	—	—	—
11. Others and margin	4,146	4,146	0.00	9,632	9,632	0.00
12. Total	30,876	31,686	810	81,129	85,989	4,860

The impact of this order of increase in exports on macro-economic variables such as gross national product, consumption, investment and the savings/GNP ratio is shown in Table 14–2. The impact on gross outputs of the eleven sectors is shown in Table 14–3. The changes in shadow price of foreign exchange between the two runs are depicted in Table 14–4.

The results reported in Tables 14–2 through 14–4 are consistent with *a priori* expectations. It turned out that, in the reference run, only the outputs of sectors 1 and 2 were limited by capacity in the first period. As such, when higher export targets are set in the simulation run, including in particular for sector 2, these are met by scaling down consumption. The additional foreign exchange earned by these exports is utilized to increase investment. However, because of the monotonicity constraint (see model description), consumption can be pushed down only to its lower bound. For these reasons, an increase of Rs.810 million in exports during 1966–69 leads only to an increase of Rs.570 million in GNP and an increase of Rs.676 million in investment. Also, because the monotonicity constraint on consumption becomes binding, its shadow prices goes up from zero in the reference run to 3.92 in the simulation run in the period 1966–69. The change in gross output of each sector other than the first two which are constrained by capacity is greater than the increase in its exports, reflecting the direct and indirect requirements. The shadow price of foreign exchange, reflecting as it does the cost of additional exports, goes up compared with the reference for the reason mentioned earlier that the additional exports are made at the expense of consumption.

However, the increase in investment in 1966–69 made possible by the availability of extra foreign exchange from additional exports, eases the capacity constraints in subsequent periods. Since, in subsequent periods, exports are further increased, the question arises whether the extra capacity created by larger investments in earlier periods is sufficient to meet the additional export demands. It turns out that up to and including the period 1972–75, the extra capacity created is not enough and consumption has got to be sacrificed relative to the reference run. This is also reflected in the higher shadow price for monotonicity of consumption (in the simulation run) in these periods.

For the last three periods, extra exports result in extra consumption and investment. Thus in the final period, increase in exports is Rs.4,860 million while the increase in GNP is Rs.17,325 million, of which Rs.10,580 million is additional consumption and Rs.6,744 million is additional investment. With production capacity increasing over time in each sector, it becomes less expensive to raise exports and hence the shadow price of foreign exchange falls below that of the reference run up to 1972–75. It becomes nearly equal in the two runs from 1975–78 on, because exports do not run into capacity constraints in the simulation run from this period.

TABLE 14–2

Macro Variables in Reference and Simulation Runs

(Rs. millions, 1959–60 prices, except row 6)

	3-yr. totals, 1966–67/1968–69			3-yr. totals, 1981–82/1983–84		
	Reference	Simulation	Difference	Reference	Simulation	Difference
1. Gross national product	775,901	776,471	+57.0	3,108,605	3,125,930	17,325
2. Consumption	510,616	510,510	−10.6	1,313,880	1,324,460	10,580
3. Investment	186,036	186,712	+67.6	1,568,975	1,575,719	6,744
4. Exports	30,876	31,686	+81.0	81,128	85,988	4,860
5. Imports	45,876	46,686	+81.0	81,128	85,988	4,860
6. Savings/GNP	0.22044	0.22114	+.00070	0.50472	0.50408	−.00064
7. Sum of discounted consumption				2,218,474	2,226,239	7,765
8. Sum of undiscounted consumption				5,215,294	5,242,540	27,245

TABLE 14–3

Gross Outputs in Reference and Simulation Runs

(Rs. millions, 1959–60 prices)

Sector	3-yr. totals, 1966–67/1968–69			3-yr. totals, 1981–82/1983–84		
	Reference	Simulation	Difference	Reference	Simulation	Difference
1. Agriculture and plantations	29,156.80	29,156.80	0.00	73,485.11	74,892.34	1,407.23
2. Mining and metals	4,829.08	4,829.08	0.00	69,858.86	69,869.69	10.83
3. Equipment	7,779.58	7,824.08	44.50	75,528.56	76,663.93	1,135.37
4. Chemicals	4,131.38	4,157.28	25.90	29,683.00	29,971.20	288.20
5. Cement and non-metals	2,547.88	2,561.39	13.51	18,243.21	18,383.26	140.05
6. Food, clothing and leather	10,530.96	10,537.45	6.49	29,080.43	29,313.75	233.32
7. Electricity	630.02	631.39	1.37	6,414.85	6,446.18	31.33
8. Transport	4,455.95	4,463.42	7.47	29,770.99	29,914.44	143.45
9. Construction	10,328.04	10,335.27	7.23	78,756.82	79,099.27	342.45
10. Housing	2,338.09	2,338.09	0.00	5,746.73	5,790.70	43.97
11. Others and margin	23,608.31	23,614.01	5.70	86,777.29	87,397.27	1,619.98

TABLE 14–4

Shadow Prices in Reference and Simulation Runs

	Foreign Exchange		Monotonicity of Consumption	
Period	Reference	Simulation	Reference	Simulation
1966–69	6.12	9.19	0.00	3.92
1969–72	11.85	2.73	0.03	0.78
1972–75	1.38	1.33	0.01	0.10
1975–78	0.73	0.72	0.00	0.00
1978–81	0.39	0.38	0.05	0.05
1981–84	0.54	0.54	0.15	0.15

NOTE: Figures represent the change in sum of discounted consumption over six periods per unit change in foreign exchange availability or the lower bound on consumption in any period.

In conclusion, we can state that additional exports in earlier years, even if they are made by pushing domestic consumption down, more than pay for themselves by increasing investment and growth in the future. Computable planning models such as the Eckaus-Parikh model are necessarily cumbersome; they build in a number of parametric assumptions and functional relationships that are less than accurate, and work with objective functions and related constraint-specifications that presuppose an accurate reflection of what the planners have in mind. In the nature of the case, therefore, any "runs" with such models can only be broadly suggestive; and, in this case, they do underline rather strongly—given the very moderate nature of the export increase specified—that a policy of promoting exports more energetically would have produced better economic results.

Appendix:

The Eckaus-Parikh Model

The variables and contraints of the so-called Guidepath I version of the Eckaus-Parikh model are given in this appendix. First we list in Table 14A–1 the variables occurring in the short-term "Target and Transit" models. Then, we list in Table 14A–2 the additional variables occurring in the Guidepath Model I. Table 14A–3 lists the constraints of the model. Some comments on the structure of this model have been made in Chapter 14 already.[5]

TABLE 14A–1

Symbols Used in the Target and Transit Models

Variables and Parameters*		Dimensions for n sectors, k activities T periods
A(t)	net foreign capital inflow in period t	T
a(t)	matrix of interindustry current flow coefficients appropriate to period t	n × k
b(t)	diagonal matrix of capital-output ratios	k × k
c(t)	column vector, each term of which indicates the proportion of the sector's output in total consumption	n
C(t)	aggregate consumption in each period	T
D(t)	vector of the amount of fixed capital (components) in each sector that is completely depreciated in period t	k
d	diagonal matrix transforming depreciation into capacity immobilized, each of whose terms d_{jj} is the maximum of $\left(\frac{r_{1j}}{p_{1j}}, \frac{r_{2j}}{p_{2j}}, \cdots, \frac{r_{nj}}{p_{nj}}\right)$; (r's and p's are explained further on in the list)	k × k

(continued)

TABLE 14A–1 (continued)

Variables and Parameters*		Dimensions for n sectors, k activities T periods
E(t)	column vector of exports by each sector	n
F(t)	column vector of deliveries by each sector for private consumption purposes	n
G(t)	column vector of deliveries by each sector for government consumption	n
H(t)	column vector of deliveries by each sector for inventory accumulation	n
I	identity matrix	$n \times n$ or $k \times k$
J(t)	column vector of deliveries of intermediate inputs by each sector	n
K(t)	column vector of fixed-capital capacity in each sector	k
M(t)	column vector of total imports	n
M′(t)	column vector of noncompetitive imports	k
m′	diagonal matrix of import coefficients relating non-competitive imports to sectoral output	$k \times k$
M″(t)	column vector of competitive imports	n
m″	column vector of coefficients indicating in each sector maximum use of the foreign exchange available after competitive import requirements have been satisfied	n
n	number of sectors	
N(t)	column vector of deliveries by each sector of investment goods for new capital formation	n
p′, p″, p‴	investment lag proportions matrices for capital; elements p_{ij}', p_{ij}'', and p_{ij}''' indicate the proportions of fixed capital in sector j supplied by sector i for new capacity 1, 2, or 3 periods ahead, respectively	$n \times k$
p	capital composition matrix where each element is $\Sigma_k p^k_{ij}$, and $\Sigma_i p_{ij} = 1.0$	$n \times k$
Q(t)	column vector of deliveries by each sector to restore depreciated capacity	n
$q\eta$	$[I - a(T) - (b(T)p'(T) + S(T))\eta - b(T)p''(T)(1 + \eta) - b(T)p'''(T)(1 + \eta)^2\eta]$ for $\eta = \phi, \delta, \gamma, \epsilon$, or ν	$n \times n$
R(t)	vector of depreciated capital capacities that are restored	k
r′, r″, r‴	matrices of coefficients, each of which indicates the proportion of depreciated capacity in each sector j supplied by sector i for restored capacity in period $t - 1$, $t - 2$, or $t - 3$, respectively, to become effective in period t	$n \times k$
r	depreciation composition matrix, each element of which is D_{ij}/D_j, where D_{ij} is the i^{th} type of capital depreciated in sector j	$n \times k$
s	matrix of inventory coefficients, each element S_{ij} of which indicates the deliveries for inventory purposes by sector i to sector j per unit of additional output in sector j	$n \times k$

(continued)

TABLE 14A-1 (concluded)

Variables and Parameters		Dimensions for n sectors, k activities T periods
T	length of the plan in periods	
t	time, in periods	
u	unit row vector [1, 1, 1, ⋯ , 1]	$1 \times n$
V(t)	column vector of capacities lost in each sector due to the depreciation of some component of its capital stock	k
W	value of the objective function, which is equal to the present discounted value of aggregate consumption over the plan period	1
w	social discount rate applied to aggregate private consumption	1
X(t)	column vector of gross domestic outputs	k
Z(t)	column vector of new additions to fixed-capital capacity in each sector	k
ϕ	postterminal growth rate for consumption	1
δ	postterminal growth rate for depreciation	1
γ	postterminal growth rate for government	1
ϵ	postterminal growth rate for exports	1
μ	postterminal growth rate for imports	
$\rho(t)$	minimum rate of growth of aggregate consumption C(t) over C(t — 1)	1
α_0	diagonal matrix of growth rates used in calculating inventory investment in first period and maximum new investment in second and third periods	T
α_T	diagonal matrix of growth rates used in calculating terminal capital requirements	$k \times k$

*Variables in capital letters; parameters in small letters.

TABLE 14A-2

Additional Variables and Parameters for the Guidepath Models

$X_1(t)$	output of the Incremental Agriculture activity in period t
$X_{12}(t)$	output of the Traditional Agriculture activity in period t
η	diagonal matrix for expenditure elasticities of consumption of each sector's output
$\lambda(t)$	population growth rate between periods t and t — 1
τ	growth rate of cultivable land available to Agriculture
$y_1 y_{12}$	yields of output per unit of land in Incremental and Traditional Agriculture, respectively
P(t)	population in period (t)
U	activity aggregation matrix
*	variables marked by asterisks, e.g. $\overset{*}{X}$, apply only to first eleven activities

TABLE 14A–3

Guidepath I and Guidepath II Models

1. Objective Function

(1.0) Maximize: $W = \sum_{t=1}^{T} \frac{C(t)}{(1+W)^{t-1}}$

Subject to:

2. Consumption Growth Constraints

(2.0) $C(t+1) \geqq (1+\rho(t))C(t)$, for $t = 0, \cdots, T-1$,

Initial consumption:

(2.1) $C(0) = \overline{C(0)}$,

3. Distribution Relationships

(3.0) $J(t)+H(t)+N(t)+Q(t)+F(t)+G(t)+E(t) \leqq M(t)+UX(t)$, for $t=1, \cdots, T$,

where $U = \begin{bmatrix} 1 & 0 & \cdot & 0 & 1 \\ 0 & 1 & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & \cdot & 1 & 0 \end{bmatrix}$

Intermediate products:

(3.1) $J(t) = a(t)X(t)$, for $t = 1, \cdots, T$,

Inventory requirements:

(3.2) $H(t) = s(t)\{X(t+1) - X(t)\}$, for $t = 2, \cdots, T$,

(3.3) $H(1) = s(1)\{X(2) - (1+\alpha_o)\overline{X(0)}\}$, for $t = 1$,

Private consumption:

(3.4) $F(t) = \eta c C(t) + \left\{ \prod_{t=1}^{t} [1+\lambda(t)] \right\} (1-\eta) c \overline{C(0)}$, for $t = 1, \cdots, T$,

Government consumption:

(3.5) $G(t) = \overline{G(t)}$, for $t = 1, \cdots, T$,

Exports:

(3.6) $E(t) = \overline{E(t)}$, for $t = 1, \cdots, 2$,

4. Capacity Restraints

(4.0) $b(t)X(t) \leqq K(t)$, for $t = 1, \cdots, T$,

5. Capital Accounting Relationships

Investment requirements:

(5.0) $N(t) = pZ(t+1)$, for $t = 1, \cdots, T$,

Depreciated capital:

(5.1) $D(t) = \overline{D(t)}$, for $t = 2, \cdots, T+1$,

Depreciated capacity:

(5.2) $V(t) = dD(t)$, for $t = 2, \cdots, T+1$,

Restoration requirements:

(5.3) $Q(t) = r(t)d(t)^{-1}R(t)$, for $t = 1, \cdots, T$,

Capital accounting:

(5.4) $K(t+1) \leqq K(t) + Z(t+1) + R(t+1) - V(t+1)$, for $t = 1, \cdots, T$,

6. Restoration Ceilings

(6.0) $R(t) \leqq V(t)$, for $t = 2, \cdots, T+1$,

7. Balance of Payments Constraints

(7.0) $uM(t) \leqq \overline{A(t)} + uE(t)$, for $t = 1, \cdots, T$,

(continued)

TABLE 14A–3 (continued)

8. Imports
Import composition:
(8.0) $M(t) = M'(t) + M''(t)$, for $t = 1, \cdots, T$,
Noncompetitive imports:
(8.1) $M'(t) = m'(t)X(t)$, for $t = 1, \cdots, T$,
Competitive import ceilings:
(8.2) $M''(t) \leq m''(t)[\overline{A(t)} + uE(t) - uM'(t)]$, for $t = 1, \cdots, T$,

9. Relationships Between Incremental and Traditional Agriculture Activities
(9.0) $X_{12}(t) - [1 + \tau]X_{12}(t - 1) \leq 0$, for $t = 1, \cdots, T$,
(9.1) $X_1(t) - \frac{y_1}{y_{12}} X_{12}(t) \leq 0$, for $t = 1, \cdots, T$,

10. Initial Capital Restraints
(10.0) $K(1) = b(1)(I + \alpha_0)\overline{X(0)}$,

11. Terminal Requirements in General
(11.0) $K(T + 1) \geq \overline{K(T + 1)}$.

12. Derivation of Terminal Conditions from Postterminal Growth Requirements
Postterminal growth rates of demands and imports:
(12.0) $C(t) = \overline{C(T)}(1 + \phi)^{t-T}$,
(12.1) $G(t) = \overline{G(T)}(1 + \gamma)^{t-T}$,
(12.2) $E(t) = \overline{E(T)}(1 + \epsilon)^{t-T}$,
(12.3) $D(t) = \overline{D(T)}(1 + \delta)^{t-T}$,
(12.4) $M(t) = \overline{M(T)}(1 + \mu)^{t-T}$,
(12.5) $X_{12}(t) = \overline{X_{12}(T)}(1 + \tau)^{t-T}$,

$$(12.6)\quad F(t) = \eta c C(T)(1 + \phi)^{t-T} + \left\{ \prod_{t=1}^{t} [1 + \lambda(t)] \right\} (I - \eta)c\overline{C(0)}.$$

This implies

$$\begin{aligned}(12.7)\quad \overset{*}{X}(t) + X_{12}(t) = {} & \overset{*}{a}(T)\overset{*}{X}(t) + [\overset{*}{s}(T) + \overset{*}{b}(T)p]\,\overset{*}{X}(t + 1) - \overset{*}{X}(t) \\ & + [a_{12}(T) + (s_{12}(T) + b_{12}(T)p_{12})\tau]\overline{X_{12}(T)}(1 + \tau)^{t-T} \\ & + \eta c C(T)(1 + \phi)^{t-T} + \prod_{t=1}^{T} (1 + \lambda(t))\,(1 - \eta)c\overline{C(0)}(1 + \lambda(T))^{t-T} \\ & + \overline{G(T)}(1 + \gamma)^{t-T} + \overline{E(T)}(1 + \epsilon)^{t-T} + \overline{D(T)}(1 + \delta)^{t-T} \\ & - M''(T)(1 + \mu)^{t-T} - \overset{*}{m}'(T)\overset{*}{X}(T)(1 + \mu)^{t-T} \\ & - m'_{12}(T)\overline{X_{12}(T)}(1 + \mu)^{t-T}, \quad \text{for } t > T.\end{aligned}$$

Define:

$$q_\xi \equiv [I - \overset{*}{a}(T) - (\overset{*}{b}(T)p + \overset{*}{s}(T))\xi], \quad \text{for } \xi \equiv \tau, \lambda(T), \phi, \gamma, \epsilon, \delta, \mu.$$

13. Particular Solution of (12.7)

$$\begin{aligned}(13.0)\quad \overset{*}{X}(T + 1) = {} & [\overset{*}{q}_\tau]^{-1}[-I + a_{12}(T) + (s_{12}(T) + b_{12}(T)p_{12})\tau]\overline{X_{12}(T)}(1 + \tau) \\ & + [\overset{*}{q}_\phi]^{-1}\eta c C(T)(1 + \phi) \\ & + [\overset{*}{q}_{\lambda(T)}]^{-1} \prod_{t=1}^{T}(1 + \lambda(t))\,(I - \eta)c\overline{C(0)}(1 + \lambda(T))\end{aligned}$$

(continued)

TABLE 14A–3 (concluded)

$$+ [\overset{*}{q}_\gamma]^{-1}\overline{E(T)}(1 + \gamma)$$

$$+ [\overset{*}{q}_\epsilon]^{-1}\overline{E(T)}(1 + \epsilon)$$

$$+ [\overset{*}{q}_\delta]^{-1}\overline{D(T)}(1 + \delta)$$

$$- [\overset{*}{q}_\mu]^{-1}M''(T)(1 + \mu)$$

$$- [\overset{*}{q}_\mu]^{-1}m'(T)\overset{*}{X}(T)(1 + \mu)$$

$$- [\overset{*}{q}_\mu]^{-1}m'_{12}(T)\overline{X_{12}(T)}(1 + \mu), \quad \text{for } t = t + 1, T + 2, T + 3.$$

14. Terminal Capital Stocks

(14.0) $\overset{*}{K}(T + 1) \geqq \overset{*}{b}(T)\overset{*}{X}(T + 1)$

$K_{12}(T + 1) \geqq b_{12}(T)\overline{X_{12}(T + 1)}$

15. Terminal Inventories

(15.0) $s(T)X(T + 1) \geqq \overset{*}{s}(T)\overset{*}{X}(T + 1) + s_{12}(T)\overline{X_{12}(T + 1)}$.

16. Consumption or Savings Constraint for the Guidepath II Model

(16.0) $\overset{*}{C}(t) + \mu G(T) \geqq \beta_0 + \beta_1\mu[(I - A)X(t) - \overline{D(t)}]$, for $t = 1, \cdots, T$.

NOTES

1. In fact, the recent evidence of the link between exports and domestic savings is based on macro-level regressions that would probably work equally well if imports were substituted for exports. See T. E. Weisskopf, "The Impact of Foreign Capital Inflow on Domestic Savings in Underdeveloped Countries," *Journal of International Economics* 2:1 (February 1972), pp. 23–38, where domestic savings are made a function of income, external resources and exports. There is no evidence in the published literature of differential savings rates *either* by industries in terms of trade orientation *or* by income classes in terms of their trade orientation.

2. R. S. Eckaus and K. Parikh, *Planning for Growth* (Cambridge: MIT Press, 1968).

3. *Ibid.*, pp. 9–10.

4. Though the intention was to postulate a considerably larger increase, in translating the intention to computation geometric growth was accidentally replaced by arithmetic growth with the consequent slowing down of the increases over time.

5. The tables in this appendix are taken from Eckaus and Parikh, *Planning,* Chapter 5.