5. Further Implications

In Section 3 we considered the solution of the model resulting from the observed values of the exogenous variables over the period 1955-1969. We will refer to this as Case I.[10] In this section we will also consider other solutions resulting from alternative series of values assigned to the exogenous variables, in particular:

Case I: actual values of the exogenous variables

Case II: constant .086 growth-rate of Z

Case III: constant .100 growth-rate of Z

Case IV: constant .037 growth-rate of X and constant .062 growth-rate of P_x

Case V: W increases each year, beginning 1957, according to $(W - W_{-1})/W_{-1} = (P_{-1} - P_{-2})/P_{-2}$

In cases II-V all the exogenous variables have their true values except those specifically cited, which are given values as described. We note that all five cases have identical solutions for 1955. Numerical results for the various cases are tabulated in Appendix 3. ERROR (1)

W. The money supply has been increasing steadily every year. Computing the geometric growth rate from $Z_{1969} = (1 + R_z)^{14} Z_{1955}$ gives $R_z = .086$. We might be interested in the results of a policy that had maintained, starting with Z_{1955}, a constant .086 rate of growth of the money supply à la Friedman. Casual inspection of the results for Case II suggests that this would have yielded slightly less erratic time-paths and also somewhat higher growth-rates for the endogenous variables (except P) compared to the observed time-paths. However,

this comparison is not quite appropriate since most of the values of the endogenous variables given by the model for 1955 are less than their actual values. Accordingly, the model starts off from a lower base, and since it tends to converge towards the actual time-paths as noted in section 3, Case II exhibits higher growth-rates. What would be more comparable are Cases I and II. It turns out that except in regard to the trade gap, Case I seems more attractive in general than Case II.

Case III involves a higher .10 growth-rate of the money supply. This gives faster growth of real output, employment, consumption and capital stock. However, the faster rise in the price level means relatively lower real wages, and the faster growth of imports presupposes that foreign saving is forthcoming to finance the larger trade gap generated by the .10 policy.

Another case worth examining, Case IV, is one where real exports and export prices increase through time at constant growth rates, for this has a bearing on the export-instability thesis. We want to compare the solution resulting from X and P_x increasing at .037 and .062 respectively (their geometric growth rates during 1955-1969) with the solution of Case I. The computations show that Case IV has less variability of the yearly growth-rates of real imports and investment. Otherwise, the two cases seem hardly distinguishable.

The last question of possible interest here is a national wage policy that conceivably might have been followed: Case V, that of increasing the money wage rate each year by the same percentage amount that the general price level increased the previous year. It is apparent that such a policy would have retarded output growth and employment quite severely, at the same time

raising the price level more than otherwise. However, there would have been smaller investment-saving and trade gaps.

6. "Predictions" for 1970

In this section we compare the model's solution for 1970 with the observed values of the endogenous variables. Official publications give the following data for the exogenous variables: $Z = 4563.3$, $W = 2252.5$ $X = 2543$, $P_x = 304.8$, $P_m = 220.9$. In addition we need a value for K. For this purpose we compute K as equal to our capital stock figure for 1968 plus the sum of the revised gross investment figures for 1968 and 1969, which gives $K = 51891$.

The following table presents the model's "predictions" with the preliminary results released by the National Economic Council . Differences between the two are expressed in percentage units of the actual, with underestimates in parentheses

	Observed	Predicted	% Difference
Y	20040	20012	(0.14)
N	n.a.	12623	-
P	197.7	192.4	(2.68)
M	3609	3877	7.42
I	3748	3621	(3.39)
T	2209	2175	(1.54)
C_p	14606	14909	2.08
C_g	1791	1962	9.57

The predicted value of Y is close to the actual, but that for P is less so. Considering, however, that the increase in P from 1969 to 1970 was 16.5% (P in 1969 was 169.8), the model's estimate seems reasonably good, especially since the percentage increase in P the previous two years were much lower, viz. 4.4% and 3.6%.

During most of 1970, the Central Bank imposed restrictive measures (including a requirement of special time deposits in connection with letters of credit for imports) which had a negative effect on imports in addition to the price effect resulting from the February devaluation. This would partly explain the relatively large overestimate of M.

The estimated values for T and C_p are not very far off from the actual values. That for C_g is rather poor, however. The explanation here would be the fiscal restraint exercised by the national government during the year as part of its commitment in order to draw on its third tranche with the International Monetary Fund.

7. Concluding Remark

As M. Mangahas has observed in his paper [4], there are not too many aggregative models of the Philippine economy. Mangahas cites four which focus on the role of foreign assistance: those presented in [1], [3], [6], and [7]. Others are given in [5], [9] and [10]. The last reference concentrates on the foreign trade sector. All these models do not involve the money supply, the price level, the money wage rate and employment as variables, which we consider important (cf. [2]). In later work we hope to extend our basic model in various directions. For the present it should be considered as highly tentative, especially in view of the defects noted in the Introduction.

Appendix 1. Convergence to a Stationary State

Consider the reduced-form equation for I at time $t = 0$, which we may write as $I_0 = aK_0 + bX_0 + f(W, Z, P_x, P_m)$. Holding the exogenous variables constant, we would then have the following table of values for I and K.

time	I	K
0	I_0	K_0
1	$I_0(1 + a)$	$K_0 + I_0$
2	$I_0(1 + a)^2$	$K_0 + I_0(2 + a)$
3	$I_0(1 + a)^3$	$K_0 + I_0(3 + 3a + a^2)$
...	. . .	. . . .
t	$I_0(1 + a)^t$	$K_0 + I_0\left[(1 + a)^t - 1\right]/a$

Thus if $-1 < a < 0$, $I \to 0$ and $K \to (K_0 - I_0/a)$ as $t \to \infty$. Note that while the stationary value of K obviously depends on the values of the exogenous variables, it is otherwise invariant with respect to initial conditions.

If X is greater by one unit in the above, we would have the same table of values but with I_0 replaced by $(I_0 + b)$ throughout. Therefore at time t, the capital stocks in this case would be greater than that above by the amount $b\left[(1 + a)^t - 1\right]/a$, which tends to $-b/a$ as t increases indefinitely. Noting that $b > 0$, with $a < 0$ this implies that the capital stock will be higher with the exogenous stocks in X.

Appendix 2

Table 2.1 Dynamic effects of a unit increase in Z_t

t	ΔK	ΔI	ΔY	ΔP	ΔN	Δ
0	0.0000	.6495	1.0840	.0376	1.1303	.4080
1	0.6495	.6450	1.3481	.0365	1.2707	.4222
2	1.2945	.6404	1.6103	.0354	1.4100	.4363
3	1.9349	.6360	1.8707	.0343	1.5484	.4503
4	2.5709	.6135	2.193	.0332	1.6859	.4639
5	3.1844	.6272	2.3788	.0322	1.8184	.4777
6	3.8116	.5961	2.6338	.0311	1.9540	.4912
∞	92.7857	0.0000	38.8107	-.1201	21.1813	2.4379

Table 2.2 Dynamic effects of a unit increase in W.

t	ΔK	ΔI	ΔY	ΔP	ΔN	ΔW
0	0.0000	-1.8335	-5.0092	.0215	-5.2234	-.2648
1	-1.8335	-1.8207	-5.7547	.0246	-5.6191	-.3051
2	-3.6542	-1.8079	-6.4950	.0277	-6.0131	-.3449
3	-5.4621	-1.7953	-7.2301	.0308	-6.4038	-.3843
4	-7.2574	-1.7827	-7.9600	.0338	-6.7917	-.4240
5	-9.0401	-1.7702	-8.6849	.0369	-7.1770	-.4624
6	-10.8103	-1.7578	-9.4047	.0399	-7.5595	-.5011
∞	-261.9285	0.0000	-111.5093	.4668	-61.8261	-5.9843

Table 2.3 Dynamic effects of a unit increase in X.

t	ΔK	ΔI	ΔY	ΔP	ΔN	ΔM
0	0.0000	.1163	0.0000	0.0000	0.0000	.3545
1	0.1163	.1155	0.0473	-0.0002	0.0251	.3573
2	0.2318	.1147	0.0942	-0.0004	0.0501	.3596
3	0.3465	.1139	0.1409	-0.0006	0.0749	.3620
4	0.4604	.1131	0.1872	-0.0008	0.0995	.3646
5	0.5735	.1123	0.2332	-0.0010	0.1239	.3668
6	0.1858	.1113	0.2788	-0.0012	0.1482	.3701
∞	16.6143	0.0000	6.7554	-0.0282	3.5904	.7183

Appendix 3

Solutions of the Model for 1955-1969

(Note: Cases I to V are discussed in section 5 of the text. The symbol "0" refers to the actual observations.)

Table 3.1 Values of Y

Year \ Case	0	I	II	III	IV	V
1955	8801	8108	8108	8108	8108	8108
1956	9437	8570	8518	8536	8570	8570
1957	9987	9257	9137	9182	9259	8895
1958	10365	9808	9711	9794	9819	9078
1959	11080	10489	10342	10476	10509	9558
1960	11229	11125	11077	11275	11153	9768
1961	11961	11767	11742	12022	11808	10379
1962	12656	12515	12439	12820	12573	10943
1963	13631	13371	13046	13549	13432	11532
1964	13970	14383	14045	14698	14413	11456
1965	14734	14992	14720	15553	15002	11807
1966	15618	15656	15399	16447	15640	12519
1967	16572	16677	16346	17650	16626	13284
1968	17597	17194	16801	18410	17110	13847
1969	18695	18164	17829	19797	18051	14313

Table 3.2 Values of N

Year \ Case	0	I	II	III	IV	V
1955	6962	6900	6900	6900	6900	6900
1956	7702	7179	7125	7144	7179	7179
1957	8174	7673	7555	7600	7674	7294
1958	8555	7987	7910	7988	7993	7252
1959	8705	8415	8294	8414	8426	7521
1960	8966	8763	8759	8932	8778	7487
1961	9245	9100	9117	9354	9122	7880
1962	9641	9552	9480	9796	9553	8193
1963	10039	10014	9714	10123	10046	8946
1964	10179	10596	10320	10840	10612	8046
1965	10322	10716	10538	11191	10721	8072
1966	10984	10878	10730	11541	10870	8462
1967	11526	11388	11173	12168	11361	8864
1968	11503	11320	11059	12272	11276	9010
1969	n.a.	11717	11538	13005	11657	9027

Table 3.3 Values of P

Year \ Case	0	I	II	III	IV	V
1955	100.0	102.2	102.2	102.2	102.2	102.2
1956	102.6	106.6	104.8	105.5	106.6	106.6
1957	105.8	110.6	107.0	108.4	110.6	112.1
1958	108.2	111.3	109.8	112.0	111.3	114.4
1959	110.0	115.4	112.7	115.9	115.3	119.4
1960	115.8	113.9	115.7	120.0	113.8	119.7
1961	118.8	117.2	119.6	125.1	117.0	123.1
1962	123.8	123.6	123.9	130.8	123.4	130.4
1963	133.0	137.4	129.2	137.8	137.2	145.3
1964	139.3	139.4	133.4	143.9	139.3	152.0
1965	143.0	141.3	139.9	152.4	141.3	155.8
1966	148.8	146.8	147.1	161.9	146.9	160.3
1967	157.0	155.6	154.0	171.5	155.8	170.1
1968	163.9	166.4	164.0	184.4	166.7	180.7
1969	169.8	171.2	172.5	196.2	171.7	187.7

Table 3.4 Values of M

Year \ Case	0	I	II	III	IV	V
1955	1319	1151	1151	1151	1151	1151
1956	1134	1151	1112	1126	1166	1167
1957	1306	1192	1116	1146	1258	1188
1958	1130	1244	1208	1254	1310	1233
1959	951	1296	1240	1303	1344	1277
1960	1043	1270	1294	1377	1354	1238
1961	1404	1336	1368	1473	1453	1299
1962	1969	1549	1545	1671	1542	1498
1963	1780	2033	1902	2053	1783	1968
1964	2155	2137	2034	2220	1973	2032
1965	2293	2340	2298	2524	2139	2224
1966	2415	2597	2577	2849	2347	2482
1967	3039	2863	2815	3139	2638	2736
1968	3239	3102	3039	3424	2914	2976
1969	3147	3144	3130	3580	3138	2996

Table 3.5 Values of I

Case / Year	0	I	II	III	IV	V
1955	1083	975	975	975	975	975
1956	1203	1071	1033	1047	1076	1076
1957	1416	1251	1174	1204	1273	1123
1958	1412	1359	1317	1366	1382	1112
1959	1580	1515	1449	1521	1534	1218
1960	1407	1598	1614	1713	1629	1174
1961	1817	1721	1749	1879	1765	1322
1962	1902	1930	1918	2085	1935	1498
1963	2192	2273	2102	2312	2199	1781
1964	2439	2478	2335	2598	2428	1638
1965	2577	2551	2479	2804	2487	1692
1966	2662	2668	2620	3017	2584	1902
1967	3034	2916	2831	3311	2836	2126
1968	3112	2958	2850	3428	2885	2254
1969	3029	3076	3027	3716	3060	2252

Table 3.6 Values of C

Year \ Case	0	I	II	III	IV	V
1955	8412	7662	7662	7662	7662	7662
1956	8762	7974	7977	7976	7974	7974
1957	9118	8464	8455	8458	8466	8175
1958	9481	8944	8900	8914	8955	8353
1959	9893	9453	9394	9426	9474	8680
1960	10312	10065	9971	10030	10094	8927
1961	10809	10584	10496	10593	10626	9383
1962	11350	11119	11046	11194	11178	9737
1963	11849	11589	11526	11739	11649	9955
1964	12296	12455	12318	12614	12485	9913
1965	12769	13061	12857	13256	13070	10239
1966	13271	13630	13394	13922	13612	10770
1967	14041	14389	14137	14822	14337	11258
1968	15167	14772	14486	15362	14687	11608
1969	16478	15607	15270	16376	15492	11979