«**Note**»

What Numerically Determines the Difference Between Catching Up and Endless Poverty in African Countries?

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Abstract

This report first intends to present the structure of growth which clarifies the difference between catching up and not catching up in Africa, compared with China and India. To do this, I use IMF national accounts data and estimating data necessary for the application of my model [2003] to this analysis. IMF national accounts data are limited in numbers and therefore I estimated other trustworthy data using a modification (based on the role of monetary policy by Friedman [1968]) of "the Penrose curve" in Uzawa [1969] so as to fit my endogenous growth model. My endogenous growth model can confirm the consistency among numerical values in national accounts by country and I believe that I could, for the first time, present these values (as long as several IMF national accounts data are available by country).

This report, second, intends to prove the existence of conditional convergence among countries. For this, I set the same values by country for the rate of saving and the relative share of profit (**0.1**), the growth rate of population (**0.02**), and *beta* (**0.8**) (which I use as the structural reform parameter calibrated in my recursive programming). In this case all the countries show the same growth rate of (per capita) output (**0.0205**). In the literature (e.g., Barro' [1989]), absolute or conditional convergence holds statistically using the panel data of many countries. However, statistical fallacies were pointed out by Friedman [1992] and Quah [1993]. Based on the fallacies, Quah [1996], using the distribution dynamics, presented a twin peaks model for per capita output, where catching up or not catching up was proved. Both approaches use the panel data.

Third, why does conditional convergence or two peaks exist/hold among countries? My intuition is: the existence depends on the classification of countries using the level of technology and their growth rate. The literature, however, does not show any numerical values for technology and growth rate. My model calibrates these values by country, together with the causes, using *beta* and *delta* whose parameter represents qualitative

improvement in technology over time.

The two policy-oriented parameters, *beta* and *delta*, are closely related to the rate of saving, the growth rate of population, the capital-labour ratio, the capital-output ratio, and the rate of profit. Catching up countries, such as Algeria and South Africa, can steadily increase the capital-labour ratio and the capital-output ratio, shifting from the second low peak group to the first high peak group, where the official rate of the Central Bank can effectively cooperate with investment effects. This is shown by the improvement of *beta* and *delta*. Not catching up or poorer countries, e.g., Ethiopia and Mali, on the other hand, cannot take advantage of the relationship among the above parameters and variables, even if the official rate is kept significantly high. The causes for this are already well known in the literature: a lack of education with an unstable political situation as investigated by the subjective and objective indicators by UN [2002].

My contributions: (1) to present the estimated values that supplement several IMF national accounts data, (2) to show the effectiveness of economic policies numerically using *beta* and *delta*, and (3) to show a modified Penrose effect that breaks the limit of growth (or supports sustainable growth) and help numerically establish the planning for catching up, using my endogenous model.

PS: The paper, whose abstract is shown as above, will be presented at the International Association for Research in Income and Wealth (IARIW), Cork, Ireland, on the 26th of Aug 2004. The paper was approved on the 21st of Nov 2003 by e-mail. I will revise the data of this note, renewing all the data using updated IMF 2003 and also revising some of data by comparing the results of my two methods: one was used in this note and the other will be added to confirm the reliability of estimated data, in particular for capital stock.

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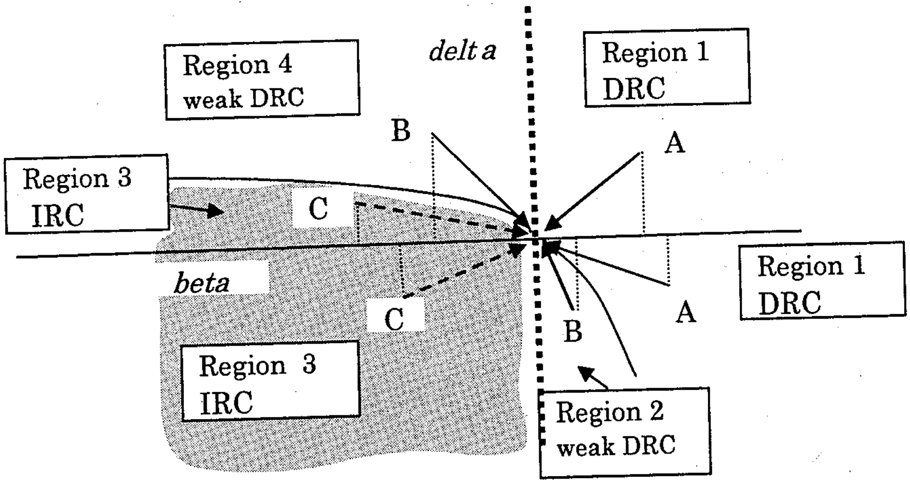

Source: Hideyuki Kamiryo. 2004. Basics of an endogenous growth model: the optimum CRC situation and conditional convergence, Figure 1. *The Journal of Economic Sciences*: 7 (February): 51–80.

Figure Classification rules for transitional paths

Notes for classification (see the Journal of Economic Sciences, February 2004)

	Region 1	Region 2	Region 3	Region 4
$\delta^*_{\beta^*} - \delta$	minus	plus	plus	minus
$\beta^*_{(\delta=0)} - \beta$	minus	minus	plus	plus
Symbols (see below)				
$k(0)^\wedge\delta^*<1$	1: strongDRC			4: strongDRC
$k(0)^\wedge\delta^*>1$	1: weakDRC	2: weakDRC	3: IRC	4: weakDRC

1. $k(0)^\wedge\delta^*<1$ shows that the current DRC situation is strong.
So that, "strong" can be added to the front of DRC: strong DRC.
2. $k(0)^\wedge\delta^*>1$ shows that the current DRC situation is weak.
So that, "weak" is added to the front of DRC: weak DRC.
3. The current situation cannot identify IRC due to CRS.
4. $k(0)^\wedge\delta^*$ works for attaining CRC by balancing productivity enhancement and DRC.

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			0.15	per SDR		0.6	0.08 =α			para= 0.42 to 0.10	k is tentative	Central Bank
		ΔKgross	Dep	Exch. rate	GDP	Y	Π	W	L	k_{ten}=α/para.	K=k*L	Disc. rate
1. China	1995	2030.1	877.7	12.3637	5851.1	3510.7	280.9	3229.8	1236.70	1.9108	2363.1	0.1044
B.Yuan	1996	2333.6	1025.0	11.9325	6833.0	4099.8	328.0	3771.8	1246.20	2.5357	3159.9	0.0900
	1997	2515.4	1123.4	11.1715	7489.5	4493.7	359.5	4134.2	1242.80	3.0634	3807.2	0.0855
	1998	2818.1	1197.8	11.6567	7985.3	4791.2	383.3	4407.9	1253.90	5.5043	6901.9	0.0459
	1999	2964.6	1230.8	11.3637	8205.4	4923.2	393.9	4529.4	1264.80	7.4301	9397.6	0.0324
	2000	3100.0	1335.7	10.7847	8904.4	5342.6	427.4	4915.2	1275.10	8.0418	10254.1	0.0324
		ΔKgross	0.2	Exch. rate	GDP		0.07		L	0.40 to 0.16		Disc. rate
2. India	1995	2894.1	1179.3	52.295	11880.1	7128.1	499.0	6629.1	921.99	3.9991	3687.1	0.1200
B. Rupees	1996	3118.5	1365.0	51.666	13682.1	8209.3	574.6	7634.6	939.54	4.5383	4264.0	0.1200
	1997	3304.2	1520.5	52.999	15225.5	9135.3	639.5	8495.8	955.22	5.7412	5484.1	0.0900
	1998	3743.4	1666.1	59.813	17409.4	10445.6	731.2	9714.4	970.93	7.0683	6862.8	0.0900
	1999	4169.4	1824.3	59.690	19296.4	11577.8	810.4	10767.4	986.61	8.6225	8507.1	0.0800
	2000	4569.8	1984.5	60.911	20879.9	12527.9	877.0	11651.0	1002.14	9.8965	9917.6	0.0800
			0.15	Exch. rate			0.065			0.48 to 0.14		Disc. rate
3. Algeria	1995	541.8	300.8	77.5576	2005.0	1203.0	60.2	1142.9	28.06	13.6254	382.3	0.1400
B. Dinars	1996	639.4	385.5	80.7931	2570.0	1542.0	77.1	1464.9	28.57	18.7558	535.9	0.1300
	1997	638.1	417.0	78.8150	2780.2	1668.1	83.4	1584.7	29.05	22.2732	647.0	0.1100
	1998	728.8	420.2	84.9790	2801.1	1680.7	84.0	1596.6	29.51	27.6184	815.0	0.0950
	1999	789.8	482.3	95.1346	3215.1	1929.1	96.5	1832.6	29.95	34.3552	1028.9	0.0850
	2000	869.3	611.8	98.1649	4078.7	2447.2	122.4	2324.9	30.99	46.9179	1454.0	0.0600
			0.15	Exch. rate			0.08			1.19 to 0.67		Disc. rate
4. Egypt	1995	33100.0	30600.0	5.0392	204000.0	122400.0	6120.0	116280.0	57.51	671.91	38641.4	0.1350
M.Pounds	1996	36760.0	34410.0	4.8718	229400.0	137640.0	6882.0	130758.0	59.31	811.94	48155.9	0.1300
	1997	58200.0	38445.0	4.5713	256300.0	153780.0	7689.0	146091.0	60.07	962.41	57811.7	0.1225
	1998	66100.0	42030.0	4.7704	280200.0	168120.0	8406.0	159714.0	61.34	1045.56	64134.7	0.1200
	1999	69170.0	45360.0	4.6734	302400.0	181440.0	9072.0	172368.0	62.65	1093.19	68488.7	0.1200
	2000	72900.0	50475.0	4.8077	336500.0	201900.0	10095.0	191805.0	63.98	1201.92	76899.0	0.1200
			0.15	Exch. rate			0.07			0.53 to 0.43		Disc. rate
5. Ethiopia	1995	5569	5082.8	9.3946	33885	20331.0	1016.6	19314.5	54.65	131.5221	7187.7	0.1200
M. Birr	1996	7246	5690.7	9.2403	37938	22762.8	1138.1	21624.7	56.37	140.6102	7926.2	n.v.
	1997	7049	6219.8	9.2613	41465	24879.0	1244.0	23635.1	58.12	147.3436	8563.6	n.v.
	1998	7927	6755.3	10.5644	45035	27021.0	1351.1	25670.0	59.88	164.3270	9839.9	n.v.
	1999			11.1640					61.67			n.v.
	2000			10.8324					63.49			n.v.

Data 1 IMF data and estimated values (1)

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		ΔKgross	Dep	Exch. rate	GDP	Y	Π	W	L	k=α/para.	K=k*L	Disc. rate
			0.15			0.6	0.06 =α			para= 0.38 to 0.2		comapre with r(0)
6. Kenya	1995	99497	69848.0	83.153	465653	279391.8	13969.6	265422.2	30.52	1559.09	47583.41	0.2450
M. Shillings	1996	104469	79195.1	79.118	527967	316780.2	15839.0	300941.2	31.80	1636.93	52054.35	0.2688
	1997	109870	93503.1	84.568	623354	374012.4	18700.6	355311.8	28.41	1951.54	55443.16	0.3227
	1998	113858	103818.0	87.165	692120	415272.0	20763.6	394508.4	29.34	3076.37	90260.72	0.1707
	1999	113215	112338.8	100.098	748925	449355.0	22467.8	426887.3	30.03	2611.25	78415.84	0.2646
	2000	116555	118337.6	101.674	788917	473350.2	23667.5	449682.7	30.67	3050.27	93551.73	0.1947
			0.15	Exch. rate			0.06			0.16 to 0.12		Disc. rate
7. Mali	1995	299.7	178.1	728.380	1187.1	712.3	35.6	676.6	9.93	38.0035	377.4	0.0750
B. Francs	1996	316.5	197.9	753.060	1319.3	791.6	39.6	752.0	10.19	45.1875	460.5	0.0650
	1997	347.7	213.4	807.940	1422.9	853.7	42.7	811.1	10.46	49.4641	517.4	0.0600
	1998	305.1	239.0	791.610	1593.6	956.2	47.8	908.4	10.74	49.7347	534.2	0.0625
	1999	312.7	250.6	896.190	1670.7	1002.4	50.1	952.3	11.04	57.8202	638.3	0.0575
	2000	318.2	251.0	918.490	1673.3	1004.0	50.2	953.8	11.35	48.7686	553.5	0.0650
				Exch. rate			0.050			0.89 to 0.44		Disc. rate
8. Nigeria	1995	115.0	20.0	32.534	1978.0	1186.8	59.3	1127.5	99.29	3.9377	391.0	0.1350
B. Naira	1996	172.0	22.0	31.471	2824.0	1694.4	84.7	1609.7	99.21	5.6180	557.4	0.1350
	1997	206.0	22.0	29.530	2940.0	1764.0	88.2	1675.8	104.96	5.4348	570.4	0.1350
	1998	194.0	22.0	30.816	2837.0	1702.2	85.1	1617.1	107.88	5.1546	556.1	0.1350
	1999	176.0	29.0	134.437	3320.0	1992.0	99.6	1892.4	110.85	4.6296	513.2	0.1800
	2000	270.0	32.0	142.734	4981.0	2988.6	149.4	2839.2	115.22	7.5758	872.9	0.1400
				Exch. rate			0.05			0.22 to 0.13		Disc. rate
9. S.Africa	1995	87042	71827	5.4220	548100	328860.0	16443.0	312417.0	41.24	2259.17	93168.3	0.1500
M. Rand	1996	99381	78923	6.7332	618417	371050.2	18552.5	352497.7	40.34	2493.77	100598.5	0.1700
	1997	113221	87188	6.5675	683730	410238.0	20511.9	389726.1	41.23	2855.41	117728.7	0.1600
	1998	125877	96588	8.2511	735504	441302.4	22065.1	419237.3	42.13	2500.25	105335.5	0.1932
	1999	124203	107933	8.4471	802840	481704.0	24085.2	457618.8	43.05	3672.69	158109.3	0.1200
	2000	132054	118699	9.8611	887795	532677.0	26633.9	506043.2	43.69	3944.46	172333.5	0.1200
			0.15	Exch. rate			0.06			0.98 to 0.14		Disc. rate
10.Tanzania	1995	591.94	453.1	818.10	3020.50	1812.3	90.6	1721.7	28.28	6.1357	173.5	0.4790
B. Shillings	1996	620.60	565.1	856.51	3767.64	2260.6	113.0	2147.6	29.09	18.3542	533.9	0.1900
	1997	692.40	705.5	842.70	4703.46	2822.1	141.1	2681.0	29.98	24.0770	721.8	0.1620
	1998	892.70	835.7	958.87	5571.64	3343.0	167.1	3175.8	33.46	25.0135	837.0	0.1760
	1999	989.34	964.9	1094.34	6432.91	3859.7	193.0	3666.8	34.29	25.2536	865.9	0.2020
	2000	1266.68	1083.9	1046.58	7225.69	4335.4	216.8	4118.6	35.12	44.8531	1575.2	0.1070

Data 1 IMF data and estimated values (2)

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$s_{\Pi}=0.6$

		$g_{Y\,(actual)}$	$g_{K\,(actual)}$	n	$L(0)$	$K(0)$	$S_{\Pi}(0)$	$D(0)$	$\Pi(0)$	$W(0)$	$Y(0)$	$S(0)=\Delta Knet$
1. China	1995	----	----	----	1236.7	2363.1	168.5	112.3	280.9	3229.8	3510.7	1152.4
B.Yuan	1996	0.16781	0.33720	0.00768	1246.2	3159.9	196.8	131.2	328.0	3771.8	4099.8	1308.7
	1997	0.09608	0.20482	(0.00273)	1242.8	3807.2	215.7	143.8	359.5	4134.2	4493.7	1392.0
840	1998	0.06620	0.81287	0.00893	1253.9	6901.9	230.0	153.3	383.3	4407.9	4791.2	1620.3
$y by ex.rate	1999	0.02756	0.36160	0.00869	1264.8	9397.6	236.3	157.5	393.9	4529.4	4923.2	1733.8
0.38851	2000	0.08519	0.09114	0.00814	1275.1	10254.1	256.4	171.0	427.4	4915.2	5342.6	1764.3
								0.0				
2. India	1995	----	----	----	922.0	3687.1	299.4	199.6	499.0	6629.1	7128.1	1714.8
B. Rupees	1996	0.15168	0.15644	0.01903	939.5	4264.0	344.8	229.9	574.6	7634.6	8209.3	1753.5
	1997	0.11280	0.28616	0.01669	955.2	5484.1	383.7	255.8	639.5	8495.8	9135.3	1783.7
450	1998	0.14344	0.25139	0.01645	970.9	6862.8	438.7	292.5	731.2	9714.4	10445.6	2077.3
$y by ex.rate	1999	0.10839	0.23959	0.01615	986.6	8507.1	486.3	324.2	810.4	10767.4	11577.8	2345.1
0.20524	2000	0.08206	0.16581	0.01574	1002.1	9917.6	526.2	350.8	877.0	11651.0	12527.9	2585.3
3. Algeria	1995	----	----	----	28.1	382.3	36.1	24.1	60.2	1142.9	1203.0	241.1
B. Dinars	1996	0.28180	0.40155	0.01818	28.6	535.9	46.3	30.8	77.1	1464.9	1542.0	253.9
	1997	0.08179	0.20749	0.01680	29.1	647.0	50.0	33.4	83.4	1584.7	1668.1	221.1
1580	1998	0.00752	0.25962	0.01583	29.5	815.0	50.4	33.6	84.0	1596.6	1680.7	308.6
$y by ex.rate	1999	0.14780	0.26247	0.01491	30.0	1028.9	57.9	38.6	96.5	1832.6	1929.1	307.5
0.80444	2000	0.26861	0.41309	0.03472	31.0	1454.0	73.4	48.9	122.4	2324.9	2447.2	257.5
4. Egypt	1995	----	----	----	57.5	38641.4	3672.0	2448.0	6120.0	116280.0	122400.0	2500.0
M.Pounds	1996	0.12451	0.24623	0.03130	59.3	48155.9	4129.2	2752.8	6882.0	130758.0	137640.0	2350.0
	1997	0.11726	0.20051	0.01281	60.1	57811.7	4613.4	3075.6	7689.0	146091.0	153780.0	19755.0
1490	1998	0.09325	0.10937	0.02114	61.3	64134.7	5043.6	3362.4	8406.0	159714.0	168120.0	24070.0
$y by ex.rate	1999	0.07923	0.06789	0.02136	62.7	68488.7	5443.2	3628.8	9072.0	172368.0	181440.0	23810.0
656.38	2000	0.11276	0.12280	0.02123	64.0	76899.0	6057.0	4038.0	10095.0	191805.0	201900.0	22425.0
5. Ethiopia	1995	----	----	----	54.7	7187.7	609.9	406.6	1016.6	19314.5	20331.0	486.3
M. Birr 100	1996	0.11961	0.10275	0.03147	56.4	7926.2	682.9	455.3	1138.1	21624.7	22762.8	1555.3
$y by ex.rate	1997	0.09297	0.08042	0.03104	58.1	8563.6	746.4	497.6	1244.0	23635.1	24879.0	829.3
42.71445	1998	0.08610	0.14904	0.03028	59.9	9839.9	810.6	540.4	1351.1	25670.0	27021.0	1171.8
	1999											
	2000											

Data 2 Data and ratios necessary for my model (1)

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$s_{\Pi}=0.6$

		$g_{Y\,(actual)}$	$g_{K\,(actual)}$	n	$L(0)$	$K(0)$	$S_{\Pi}(0)$	$D(0)$	$\Pi(0)$	$W(0)$	$Y(0)$	$S(0)=\Delta Knet$
6. Kenya	1995	----	----	----	30.5	47583.4	8381.8	5587.8	13969.6	265422.2	279391.8	29649.1
M. Shillings	1996	0.13382	0.09396	0.04194	31.8	52054.3	9503.4	6335.6	15839.0	300941.2	316780.2	25274.0
	1997	0.18067	0.06510	(0.10660)	28.4	55443.2	11220.4	7480.2	18700.6	355311.8	374012.4	16366.9
350	1998	0.11032	0.62799	0.03273	29.3	90260.7	12458.2	8305.4	20763.6	394508.4	415272.0	10040.0
$y by ex.rate	1999	0.08207	(0.13123)	0.02352	30.0	78415.8	13480.7	8987.1	22467.8	426887.3	449355.0	876.3
151.79549	2000	0.05340	0.19302	0.02131	30.7	93551.7	14200.5	9467.0	23667.5	449682.7	473350.2	(1782.5)
							0.0					
7. Mali	1995	----	----	----	9.9	377.4	21.4	14.2	35.6	676.6	712.3	121.6
B. Francs	1996	0.11136	0.22017	0.02618	10.2	460.5	23.7	15.8	39.6	752.0	791.6	118.6
	1997	0.07853	0.12365	0.02650	10.5	517.4	25.6	17.1	42.7	811.1	853.7	134.3
240	1998	0.11997	0.03239	0.02677	10.7	534.2	28.7	19.1	47.8	908.4	956.2	66.1
$y by ex.rate	1999	0.04838	0.19505	0.02793	11.0	638.3	30.1	20.0	50.1	952.3	1002.4	62.1
0.09631	2000	0.00156	(0.13286)	0.02808	11.4	553.5	30.1	20.1	50.2	953.8	1004.0	67.2
							0.0					
8. Nigeria	1995	----	----	----	99.3	391.0	35.6	23.7	59.3	1127.5	1186.8	95.0
B. Naira	1996	0.42770	0.42558	(0.00081)	99.2	557.4	50.8	33.9	84.7	1609.7	1694.4	150.0
	1997	0.04108	0.02346	0.05796	105.0	570.4	52.9	35.3	88.2	1675.8	1764.0	184.0
260	1998	(0.03503)	(0.02516)	0.02782	107.9	556.1	51.1	34.0	85.1	1617.1	1702.2	172.0
$y by ex.rate	1999	0.17025	(0.07713)	0.02753	110.9	513.2	59.8	39.8	99.6	1892.4	1992.0	147.0
0.18172	2000	0.50030	0.70087	0.03942	115.2	872.9	89.7	59.8	149.4	2839.2	2988.6	238.0
9. S.Africa	1995	----	----	----	41.2	93168.3	9865.8	6577.2	16443.0	312417.0	328860.0	15215.0
M. Rand	1996	0.12829	0.07975	(0.02182)	40.3	100598.5	11131.5	7421.0	18552.5	352497.7	371050.2	20458.0
	1997	0.10561	0.17028	0.02206	41.2	117728.7	12307.1	8204.8	20511.9	389726.1	410238.0	26033.0
3020	1998	0.07572	(0.10527)	0.02183	42.1	105335.5	13239.1	8826.0	22065.1	419237.3	441302.4	29289.0
$y by ex.rate	1999	0.09155	0.50101	0.02184	43.1	158109.3	14451.1	9634.1	24085.2	457618.8	481704.0	16270.0
1236.39	2000	0.10582	0.08996	0.01487	43.7	172333.5	15980.3	10653.5	26633.9	506043.2	532677.0	13355.0
10.Tanzania	1995	----	----	----	28.3	173.5	54.4	36.2	90.6	1721.7	1812.3	138.9
B. Shillings	1996	0.24736	2.07705	0.02864	29.1	533.9	67.8	45.2	113.0	2147.6	2260.6	55.5
	1997	0.24838	0.35193	0.03059	30.0	721.8	84.7	56.4	141.1	2681.0	2822.1	(13.1)
270	1998	0.18458	0.15949	0.11608	33.5	837.0	100.3	66.9	167.1	3175.8	3343.0	57.0
$y by ex.rate	1999	0.15458	0.03464	0.02481	34.3	865.9	115.8	77.2	193.0	3666.8	3859.7	24.4
0.11795	2000	0.12324	0.81910	0.02421	35.1	1575.2	130.1	86.7	216.8	4118.6	4335.4	182.8

Note: $g_{K\,(actual)}$ is not used for Root Mean Square Error method. When this rate is derived using two periods' stock difference, it is used for A(t).

Data 2 Data and ratios necessary for my model (2)

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		alpha	Omega(0)	r(0)	k(0)	y(0)	s	s_{Π}	s_H	$s_{S\Pi/Y}$	A(0)	$g_{A\,(actual)}$
1. China	1995	0.08000	0.67312	0.11885	1.91	2.84	0.32827	0.60000	0.29440	0.04800	2.70	----
B.Yuan	1996	0.08000	0.77075	0.10379	2.54	3.29	0.31920	0.60000	0.28487	0.04800	3.05	0.1338
	1997	0.08000	0.84722	0.09443	3.06	3.62	0.30976	0.60000	0.27496	0.04800	3.31	0.0822
840	1998	0.08000	1.44054	0.05553	5.50	3.82	0.33818	0.60000	0.30482	0.04800	3.33	(0.0070)
$y by ex.rate	1999	0.08000	1.90883	0.04191	7.43	3.89	0.35216	0.60000	0.31950	0.04800	3.32	(0.0094)
0.38851	2000	0.08000	1.91930	0.04168	8.04	4.19	0.33024	0.60000	0.29647	0.04800	3.55	0.0704
2. India	1995	0.07000	0.51727	0.13533	4.00	7.73	0.24057	0.60000	0.20728	0.04200	7.02	----
B. Rupees	1996	0.07000	0.51941	0.13477	4.54	8.74	0.21360	0.60000	0.17912	0.04200	7.86	0.1230
	1997	0.07000	0.60032	0.11660	5.74	9.56	0.19525	0.60000	0.15997	0.04200	8.46	0.0773
450	1998	0.07000	0.65700	0.10654	7.07	10.76	0.19887	0.60000	0.16374	0.04200	9.38	0.1105
$y by ex.rate	1999	0.07000	0.73477	0.09527	8.62	11.73	0.20255	0.60000	0.16759	0.04200	10.09	0.0766
0.20524	2000	0.07000	0.79164	0.08842	9.90	12.50	0.20636	0.60000	0.17157	0.04200	10.65	0.0558
3. Algeria	1995	0.05000	0.31781	0.15733	13.63	42.87	0.20037	0.60000	0.17564	0.03000	37.62	----
B. Dinars	1996	0.05000	0.34750	0.14388	18.76	53.97	0.16466	0.60000	0.13882	0.03000	46.61	0.2445
	1997	0.05000	0.38788	0.12890	22.27	57.42	0.13253	0.60000	0.10570	0.03000	49.17	0.0555
1580	1998	0.05000	0.48494	0.10311	27.62	56.95	0.18364	0.60000	0.15839	0.03000	48.24	(0.0205)
$y by ex.rate	1999	0.05000	0.53339	0.09374	34.36	64.41	0.15942	0.60000	0.13342	0.03000	53.97	0.1205
0.80444	2000	0.05000	0.59414	0.08416	46.92	78.97	0.10522	0.60000	0.07755	0.03000	65.15	0.2150
4. Egypt	1995	0.05000	0.31570	0.15838	671.9	2128.3	0.02042	0.60000	(0.00987)	0.03000	1537.00	----
M.Pounds	1996	0.05000	0.34987	0.14291	811.9	2320.7	0.01707	0.60000	(0.01333)	0.03000	1660.12	0.0825
	1997	0.05000	0.37594	0.13300	962.4	2560.0	0.12846	0.60000	0.10151	0.03000	1815.83	0.0951
1490	1998	0.05000	0.38148	0.13107	1045.6	2740.8	0.14317	0.60000	0.11667	0.03000	1936.01	0.0677
$y by ex.rate	1999	0.05000	0.37747	0.13246	1093.2	2896.1	0.13123	0.60000	0.10436	0.03000	2041.16	0.0555
656.37907	2000	0.05000	0.38088	0.13128	1201.9	3155.7	0.11107	0.60000	0.08358	0.03000	2213.60	0.0865
5. Ethiopia	1995	0.05000	0.35353	0.14143	131.52	372.02	0.02392	0.60000	(0.00627)	0.03000	291.49	----
M. Birr 100	1996	0.05000	0.34821	0.14359	140.61	403.81	0.06833	0.60000	0.03951	0.03000	315.34	0.0846
$y by ex.rate	1997	0.05000	0.34421	0.14526	147.34	428.06	0.03333	0.60000	0.00343	0.03000	333.50	0.0595
42.71445	1998	0.05000	0.36416	0.13730	164.33	451.25	0.04336	0.60000	0.01378	0.03000	349.65	0.0499
	1999											
	2000											

Data 3 Key ratios calculated using data (1)

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		alpha	Omega(0)	r(0)	k(0)	y(0)	s	s_{Π}	s_H	$s_{S\Pi/Y}$	A(0)	$g_{A\,(actual)}$
6. Kenya	1995	0.05000	0.17031	0.29358	1559.09	9154.38	0.10612	0.60000	0.07847	0.03000	6338.49	----
M. Shillings	1996	0.05000	0.16432	0.30428	1636.93	9961.64	0.07978	0.60000	0.05132	0.03000	6880.65	0.0893
	1997	0.05000	0.14824	0.33729	1951.54	13164.82	0.04376	0.60000	0.01419	0.03000	9013.55	0.2787
350	1998	0.05000	0.21735	0.23004	3076.37	14153.78	0.02418	0.60000	-0.00600	0.03000	9472.63	0.0478
$y by ex.rate	1999	0.05000	0.17451	0.28652	2611.25	14963.54	0.00195	0.60000	-0.02892	0.03000	10096.99	0.0663
151.79549	2000	0.05000	0.19764	0.25299	3050.27	15433.66	-0.00377	0.60000	-0.03481	0.03000	10333.61	0.0235
7. Mali	1995	0.05000	0.52983	0.09437	38.00	71.73	0.17077	0.60000	0.14513	0.03000	59.80	----
B. Francs	1996	0.05000	0.58170	0.08596	45.19	77.68	0.14983	0.60000	0.12354	0.03000	64.21	0.0755
	1997	0.05000	0.60603	0.08250	49.46	81.62	0.15727	0.60000	0.13120	0.03000	67.16	0.0472
240	1998	0.05000	0.55864	0.08950	49.73	89.03	0.06909	0.60000	0.04030	0.03000	73.23	0.0929
$y by ex.rate	1999	0.05000	0.63679	0.07852	57.82	90.80	0.06195	0.60000	0.03293	0.03000	74.13	0.0121
0.09631	2000	0.05000	0.55133	0.09069	48.77	88.46	0.06694	0.60000	0.03808	0.03000	72.83	(0.0185)
8. Nigeria	1995	0.05000	0.32943	0.15178	3.94	11.95	0.08005	0.60000	0.05160	0.03000	11.16	----
B. Naira	1996	0.05000	0.32894	0.15200	5.62	17.08	0.08853	0.60000	0.06034	0.03000	15.67	0.4072
	1997	0.05000	0.32338	0.15462	5.43	16.81	0.10431	0.60000	0.07661	0.03000	15.44	(0.0152)
260	1998	0.05000	0.32668	0.15305	5.15	15.78	0.10105	0.60000	0.07324	0.03000	14.54	(0.0602)
$y by ex.rate	1999	0.05000	0.25763	0.19408	4.63	17.97	0.07380	0.60000	0.04515	0.03000	16.64	0.1480
0.18172	2000	0.05000	0.29207	0.17119	7.58	25.94	0.07964	0.60000	0.05117	0.03000	23.44	0.4278
9. S.Africa	1995	0.05000	0.28331	0.17649	2259.17	7974.30	0.04627	0.60000	0.01677	0.03000	5419.95	----
M. Rand	1996	0.05000	0.27112	0.18442	2493.77	9198.07	0.05514	0.60000	0.02591	0.03000	6220.91	0.1450
	1997	0.05000	0.28698	0.17423	2855.41	9949.99	0.06346	0.60000	0.03449	0.03000	6684.04	0.0761
3020	1998	0.05000	0.23869	0.20947	2500.25	10474.78	0.06637	0.60000	0.03749	0.03000	7083.46	0.0602
$y by ex.rate	1999	0.05000	0.32823	0.15233	3672.69	11189.41	0.03378	0.60000	0.00389	0.03000	7422.63	0.0458
1236.4	2000	0.05000	0.32352	0.15455	3944.46	12192.20	0.02507	0.60000	-0.00508	0.03000	8059.03	0.0872
10.Tanzania	1995	0.05000	0.09574	0.52222	6.14	64.08	0.07662	0.60000	0.04807	0.03000	58.53	----
B. Shillings	1996	0.05000	0.23619	0.21170	18.35	77.71	0.02453	0.60000	-0.00564	0.03000	67.19	0.1163
	1997	0.05000	0.25578	0.19548	24.08	94.13	-0.00465	0.60000	-0.03572	0.03000	80.29	0.2017
270	1998	0.05000	0.25036	0.19971	25.01	99.91	0.01704	0.60000	-0.01336	0.03000	85.05	0.0663
$y by ex.rate	1999	0.05000	0.22435	0.22286	25.25	112.56	0.00632	0.60000	-0.02441	0.03000	95.78	0.1293
0.11795	2000	0.05000	0.36334	0.13761	44.85	123.45	0.04217	0.60000	0.01255	0.03000	102.07	0.0593

Data 3 Key ratios calculated using data (2)

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	Year	delta	$\delta^*=LOG(m,k)$	beta	$\beta^*_{delta=0}$	$m=k(0)^\wedge\delta^*$	Signs	Region & situation	Slope	Speed (2): $\Omega(0)=\Omega^*$ Speed	$g_A(t)$	t=1000 $g_y(t)=g_k(t)$	numer. $\delta^*_{\beta^*}-\delta$	denom. $\beta^*_{(\delta=0)}-\beta$
1. China														
B.Yuan	1996	0.0065	(0.0159)	0.8846	0.4545	0.9862	-/-=+	1: sDRC	0.05	38	0.1437	0.1571	(0.0225)	(0.4301)
	2000	0.0097	(0.0010)	0.8856	0.6591	0.9981	-/-=+	1: sDRC	0.05	62	0.0940	0.1026	(0.0108)	(0.2265)
n=0	2000	0.0084	(0.0450)	0.9074	*0.6398*	0.9170	-/-=+	1: sDRC	0.20	67	0.0936	0.1021	(0.0534)	(0.2676)
n=0 & 0.75L	2000	0.0082	(0.0392)	0.9095	*0.6398*	0.9170	-/-=+	1: sDRC	0.18	81	0.0936	0.1021	(0.0474)	(0.2697)
same paras.	2000	0.0044	0.1838	0.8000	0.7773	1.4242	+/-=-	2: wDRC	(7.90)	165	0.0179	0.0199	0.1794	(0.0227)
The same parameters: n=0.02, α=s=0.1, and $beta^*$=0.8.														
2. India														
B. Rupees	1996	0.0064	(0.0002)	0.8142	0.3978	0.9997	-/-=+	1: sDRC	0.02	52	0.1079	0.1165	(0.0066)	(0.4163)
	2000	0.0062	(0.0021)	0.8238	0.5023	0.9951	-/-=+	1: sDRC	0.03	62	0.0940	0.1015	(0.0084)	(0.3215)
n=0	2000	0.0116	(0.0761)	0.8267	*0.4599*	0.8399	-/-=+	1: sDRC	0.24	71	0.0940	0.1015	(0.0877)	(0.3669)
n=0 & 0.75L	2000	0.01134	(0.0676)	0.8302	*0.4599*	0.8399	-/-=+	1: sDRC	0.21	71	0.0940	0.1015	(0.0790)	(0.3703)
same paras.	2000	0.0202	0.1387	0.8000	0.5637	1.3743	+/-=-	2: wDRC	(0.50)	195	0.0177	0.0197	0.1185	(0.2363)
3. Algeria														
B. Dinars	1996	(0.0000)	(0.0005)	0.6803	0.3048	0.9985	-/-=+	1: sDRC	0.00	76	0.0957	0.1010	(0.0005)	(0.3756)
	2000	(0.0148)	0.0003	0.6979	0.5318	1.0012	+/-=-	2: wDRC	(0.09)	80	0.0422	0.0445	0.0151	(0.1661)
n=0	2000	(0.0148)	(0.1548)	0.6979	0.3848	0.5511	-/-=+	1: sDRC	0.45	112	0.0555	0.0585	(0.1400)	(0.3131)
4. Egypt														
M.Pounds	1996	(0.0791)	0.0037	0.7055	0.6790	1.0250	+/-=-	2: wDRC	(3.12)	145	0.0064	0.0067	0.0828	(0.0265)
	2000	0.0055	0.0006	0.6696	0.3510	1.0041	-/-=+	1: wDRC	0.02	69	0.0616	0.0650	(0.0049)	(0.3187)
n=0	2000	0.0055	(0.0417)	0.6696	0.2862	0.7439	-/-=+	1: sDRC	0.12	86	0.0677	0.0714	(0.0472)	(0.3835)
5. Ethiopia														
M. Birr	1996	(0.0047)	0.0015	0.5845	0.4055	1.0073	+/-=-	2: wDRC	(0.03)	103	0.0361	0.0381	0.0061	(0.1790)
	1998	(0.0133)	0.0012	0.8707	0.4774	1.0066	+/-=-	2: wDRC	(0.04)	113	0.0213	0.0224	0.0145	(0.3933)
n=0	1998	(0.0133)	(0.1694)	0.8707	*0.2771*	0.4213	-/-=+	1: sDRC	0.26	164	0.0294	0.0310	(0.1562)	(0.5936)
n=0 & 0.75L	1998	(0.0102)	(0.1604)	0.4769	*0.2771*	0.4213	-/-=+	1: sDRC	0.75	168	0.0294	0.0310	(0.1502)	(0.1998)
same paras.	1998	0.0354	(0.1166)	0.8000	0.3521	0.5516	-/-=+	1: sDRC	0.34	164	0.0172	0.0191	(0.1520)	(0.4479)

Data 4 Transitional paths: each sign, slope, and speed by country and year (1)

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		delta	$\delta^*=LOG(m,k)$	*beta*	$\beta^*_{delta=0}$	$m=k(0)$^δ^*	Signs	Region & situation	Slope	Speed (2): Ω(0)=Ω* Speed	$g_A(t)$	$g_y(t)=g_k(t)$		
6. Kenya M. Shillings	1996	0.0071	0.0001	0.5246	0.2363	1.0007	-/-=+	1: wDRC	0.02	80	0.0533	0.0562	(0.0070)	(0.2883)
	2000	(0.3717)	(0.0003)	0.9798	1.3381	0.9975	irregular	irregular	1.04	307	(0.0010)	(0.0011)	0.3714	0.3583
n=0	2000	(0.3717)	#NUM!	0.9798	0.1722	(0.0525)	+/-=-	2: wDRC	#NUM!	1800	0.0025	0.0026	#NUM!	(0.8076)
7. Mali B. Francs	1996	0.0075	0.0009	0.7127	0.4602	1.0034	-/-=+	1: wDRC	0.03	74	0.0276	0.0291	(0.0066)	(0.2525)
	2000	0.0616	(0.0005)	1.4021	0.5365	0.9980	-/-=+	1: sDRC	0.07	114	0.0276	0.0291	(0.0621)	(0.8655)
n=0	2000	0.0616	(0.1780)	1.4021	0.3672	0.5007	-/-=+	1: sDRC	0.23	141	0.0377	0.0397	(0.2396)	(1.0348)
8. Nigeria B. Naira	1996	(0.0125)	(0.0003)	0.5241	0.2545	0.9995	+/-=-	2: wDRC	(0.05)	96	0.0573	0.0604	0.0122	(0.2697)
	2000	(0.0189)	0.0002	0.5413	0.3673	1.0004	+/-=-	2: wDRC	(0.11)	123	0.0441	0.0465	0.0190	(0.1739)
n=0	2000	(0.0144)	(0.3139)	0.4980	0.2351	0.5296	-/-=+	1: sDRC	1.14	213	0.0533	0.0562	(0.2994)	(0.2628)
9. S.Africa M. Rand	1996	(0.0031)	(0.0001)	0.4655	0.1259	0.9993	+/-=-	2: wDRC	(0.01)	242	0.0438	0.0461	0.0030	(0.3396)
	2000	(0.0300)	0.0012	0.5617	0.3940	1.0098	+/-=-	2: wDRC	(0.19)	219	0.0158	0.0167	0.0312	(0.1677)
n=0	2000	(0.0300)	(0.07734)	0.5617	*0.2540*	0.5271	-/-=+	1: sDRC	0.15	284	0.0194	0.0205	(0.0473)	(0.3077)
n=0 & 0.75L	2000	(0.0246)	(0.0747)	0.4926	*0.2540*	0.5271	-/-=+	1: sDRC	0.21	284	0.0194	0.0205	(0.0502)	(0.2385)
same paras.	2000	(0.0300)	(0.0427)	0.8000	0.3233	0.7021	-/-=+	1: sDRC	0.03	165	0.0172	0.0191	(0.0127)	(0.4767)
The same parameters: n=0.02, $\alpha=s$=0.1, and $beta^*$=0.8.														
10.Tanzania B. Shillings	1996	(0.0730)	0.0009	0.4905	0.4139	1.0025	+/-=-	2: wDRC	(0.96)	141	0.0150	0.0158	0.0739	(0.0766)
	2000	(0.0212)	0.0006	0.5270	0.4405	1.0024	+/-=-	2: wDRC	(0.25)	122	0.0222	0.0234	0.0219	(0.0865)
n=0	2000	(0.0212)	(0.1894)	0.5270	0.2767	0.4865	-/-=+	1: sDRC	0.67	178	0.0287	0.0303	(0.1682)	(0.2503)

Data 4 Transitional paths: each sign, slope, and speed by country and year (2)

Table 1 The relationship between *beta* and *delta* under the current and CRC situations

	delta	*delta**	*beta*	$\beta_{delta=0}$	δ*−δ	β*−β	Conv.speed
China1996	0.0065	(0.0159)	0.8846	0.4545	(0.0225)	(0.4301)	38
2000	0.0175	(0.0377)	0.8856	0.6591	(0.0552)	(0.2265)	62
India1996	0.0064	(0.0002)	0.8142	0.3978	(0.0066)	(0.4163)	52
2000	0.0062	(0.0761)	0.8238	0.5023	(0.0823)	(0.3215)	62
Algeria1996	(0.0000)	(0.0005)	0.6803	0.3048	(0.0005)	(0.3756)	76
2000	(0.0148)	(0.1548)	0.6979	0.5318	(0.1400)	(0.1661)	80
Egypt1996	(0.0791)	0.0037	0.7055	0.6790	0.0828	(0.0265)	145
2000	0.0055	0.0006	0.6696	0.3510	(0.0049)	(0.3187)	69
Ethiopia1996	(0.0047)	0.0015	0.5845	0.4055	0.0061	(0.1790)	103
'1998	(0.0133)	0.0012	0.8707	0.4774	0.0145	(0.3933)	113
Kenya1996	0.0071	0.0001	0.5246	0.2363	(0.0070)	(0.2883)	80
2000	(0.3717)	#NUM!	0.9798	1.3381	#NUM!	0.3583	307
Mali1996	0.0075	0.0009	0.7127	0.4602	(0.0066)	(0.2525)	74
2000	0.0616	(0.1780)	1.4021	0.5365	(0.2396)	(0.8655)	114
Nigeria1996	(0.0125)	(0.0003)	0.5241	0.2545	0.0122	(0.2697)	96
2000	(0.0189)	0.0002	0.5413	0.3673	0.0190	(0.1739)	123
S.Africa1996	(0.0031)	(0.0001)	0.4655	0.1259	0.0030	(0.3396)	242
2000	(0.0300)	0.0011	0.5617	0.3940	0.0312	(0.1677)	219
Tanzania1996	(0.0730)	0.0009	0.4905	0.4139	0.0739	(0.0766)	141
2000	(0.0212)	0.0006	0.5270	0.4405	0.0219	(0.0865)	122

	n	α	*beta* $(\delta=0)$	*i*	$\Omega(0)$
China2000	0.00814	0.08	0.6591	0.27379	1.9193
Ethiopia98	0.03028	0.05	0.4774	0.04069	0.36416
Nigeria2000	0.03942	0.05	0.3673	0.06971	0.29267

	$\Omega(0)$			$r=alpha/\Omega(0)$		
i	China2000	Ethiopia98	Nigeria2000	China2000	Ethiopia98	Nigeria2000
-0.050	3.1272	-12.2884	-3.8187	0.0256	-0.0041	-0.0131
-0.025	13.7424	-0.7408	-0.4153	0.0058	-0.0675	-0.1204
0	0.0000	0.0000	0.0000			
0.025	0.9427	0.2685	0.1619	0.0849	0.1862	0.3088
0.05	1.2288	0.4072	0.2481	0.0651	0.1228	0.2015
0.075	1.3672	0.4919	0.3016	0.0585	0.1016	0.1658
0.1	1.4487	0.5490	0.3381	0.0552	0.0911	0.1479
0.2	1.5910	0.6648	0.4131	0.0503	0.0752	0.1210
0.3	1.6449	0.7150	0.4460	0.0486	0.0699	0.1121
				#DIV/0!	#DIV/0!	#DIV/0!

Using Eq 18 in Kamiryo [2003]: $\Omega=(\beta\ i(1-\alpha))/(i(1-\beta)(1+n)+n(1-\alpha))$ *and* under the assumption that α, n and *beta* $_{delta^*=0}$ are constant:

1. At $i=0$, the capital-output ratio is also zero.
2. the vertical asymtotoe of this cirve lies at the value between -0.025 and -0.05.
3. Along with the increase in the investment ratio the capital-output ratio increases slightly.

Table 2 The tendencies of the official rate given by the Central Bank by country

	1995	1996	1997	1998	1999	2000
1. China	0.1044	0.0900	0.0855	0.0459	0.0324	0.0324
2. India	0.1200	0.1200	0.0900	0.0900	0.0800	0.0800
3. Algeria	0.1400	0.1300	0.1100	0.0950	0.0850	0.0600
4. Egypt	0.1350	0.1300	0.1225	0.1200	0.1200	0.1200
5. Ethiopia	0.1200	n.v.	n.v.	n.v.	n.v.	n.v.
6. Kenya	0.2450	0.2688	0.3227	0.1707	0.2646	0.1947
7. Mali	0.0750	0.0650	0.0600	0.0625	0.0575	0.0650
8. Nigeria	0.1350	0.1350	0.1350	0.1350	0.1800	0.1400
9. S.Africa	0.1500	0.1700	0.1600	0.1932	0.1200	0.1200
10.Tanzania	0.4790	0.1900	0.1620	0.1760	0.2020	0.1070

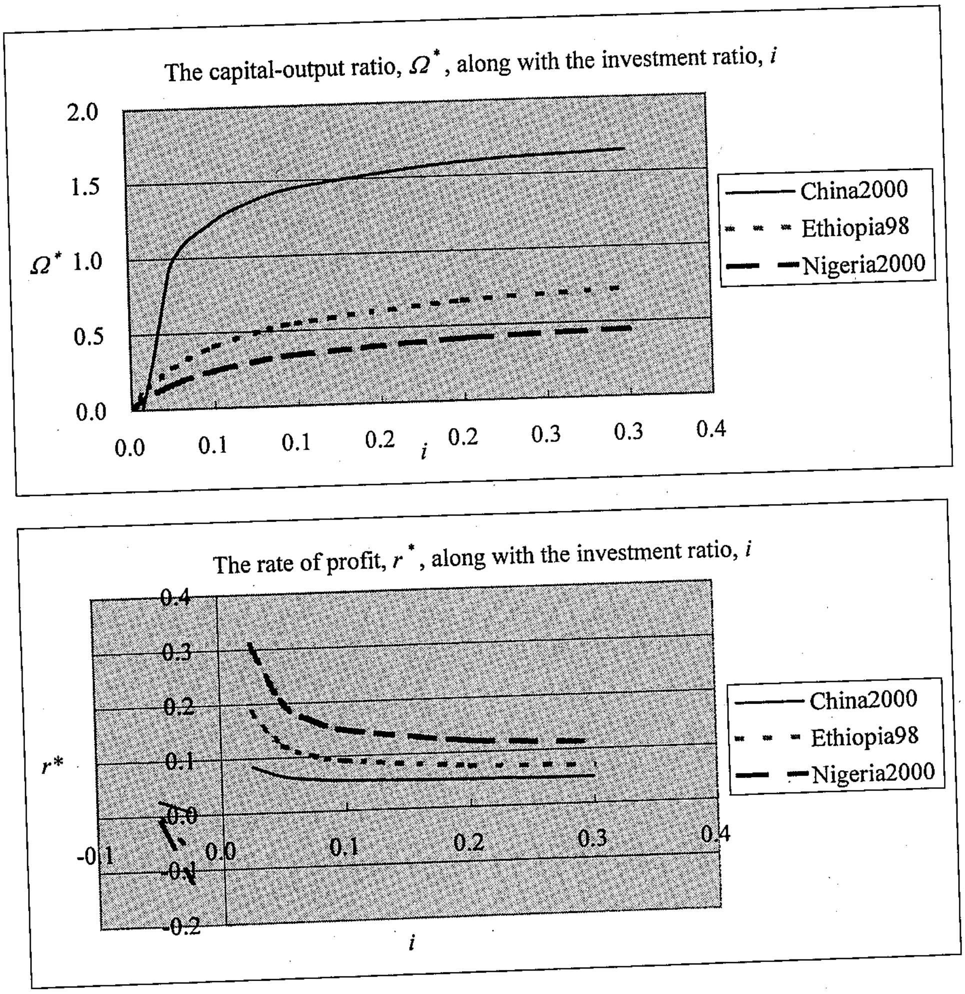


Figure 1 The capital-output ratio and the rate of profit along with the investment ratio

F234 inAbstract beta& del5ps

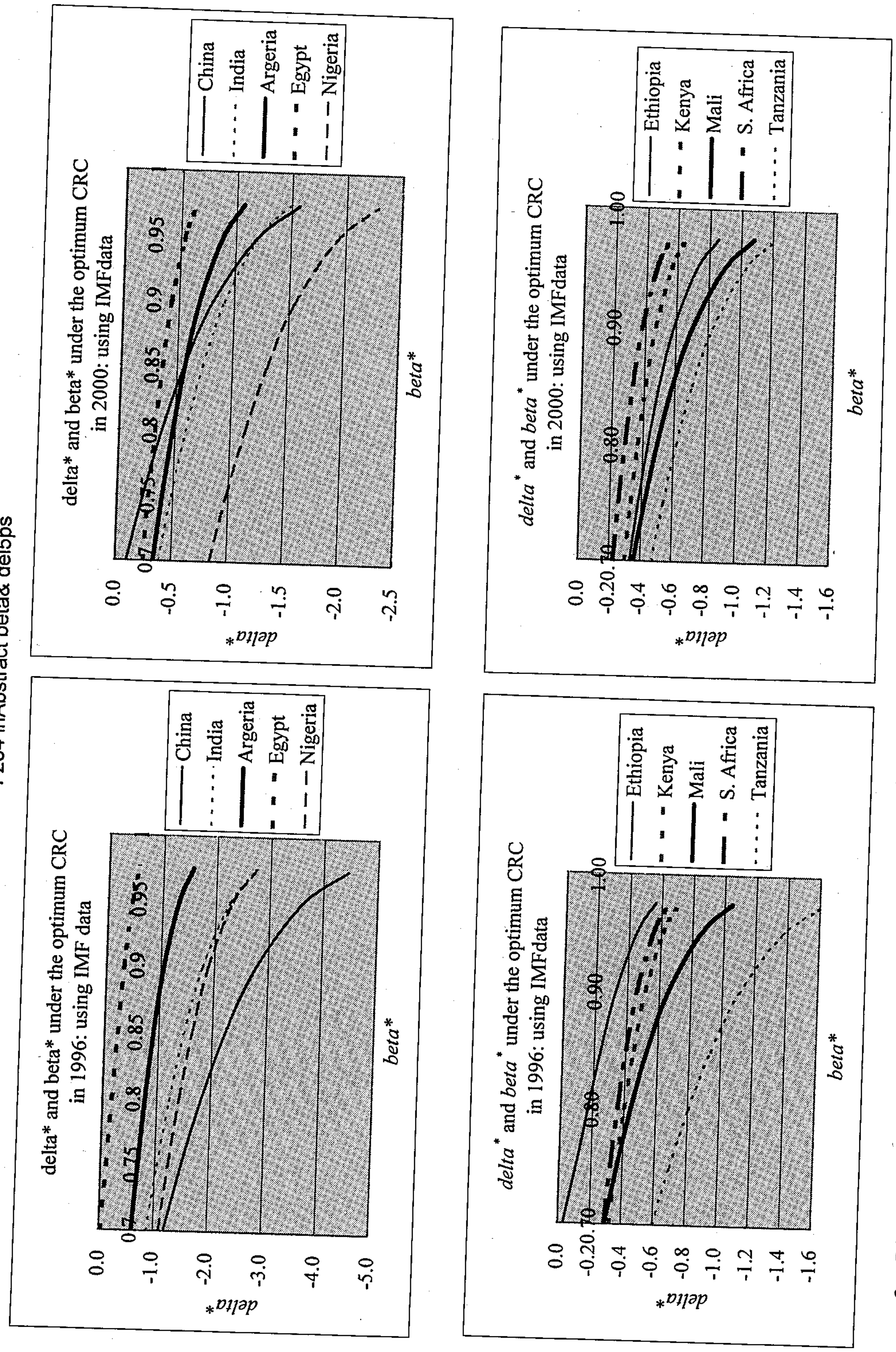


Figure 2 The relationship between *beta** and *delta** in 2000 and 1996

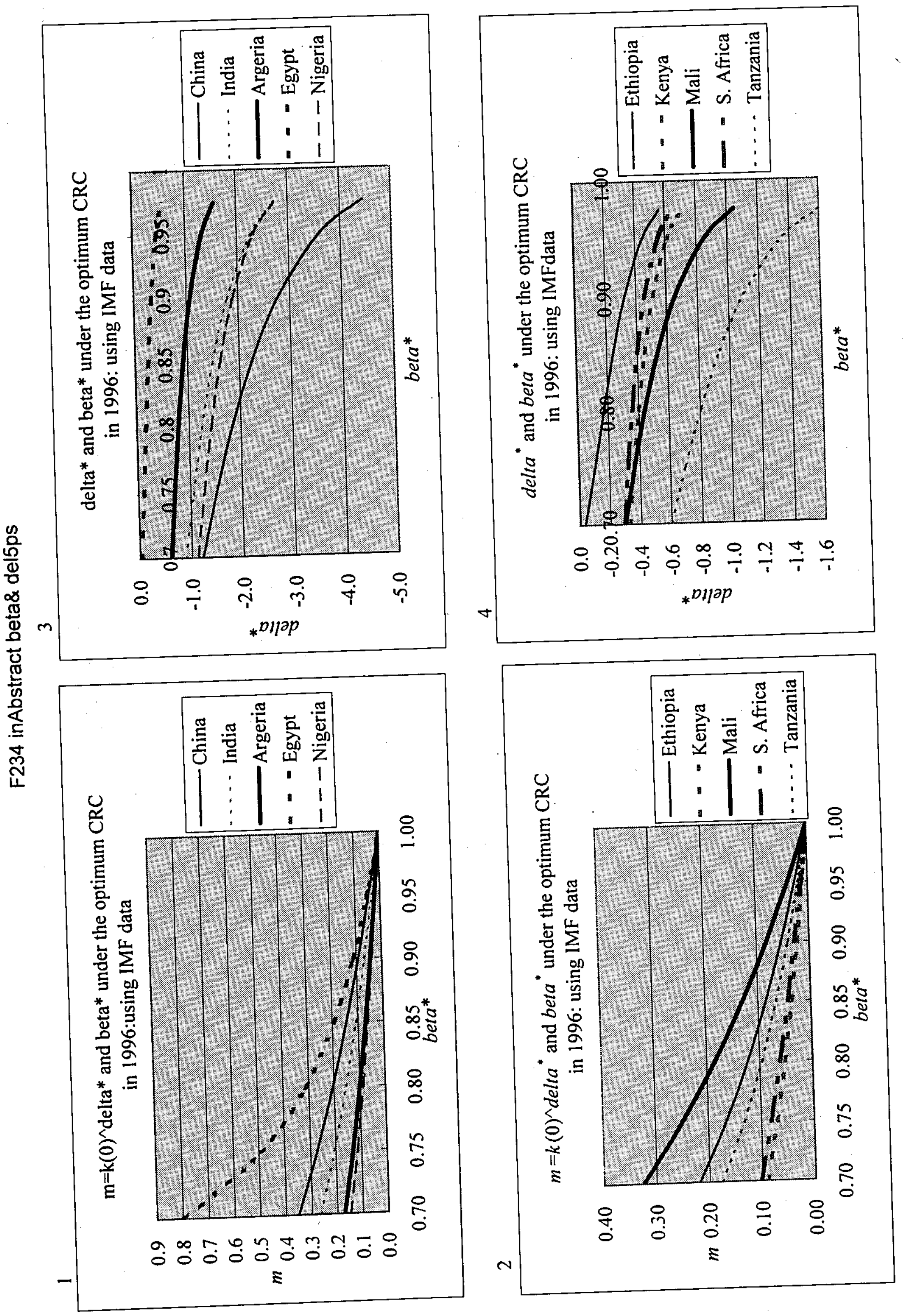


Figure 3 The relationship between $beta^*$ and $m=k(0)$^$delta^*$ in 1996

F234 inAbstract beta& del5ps

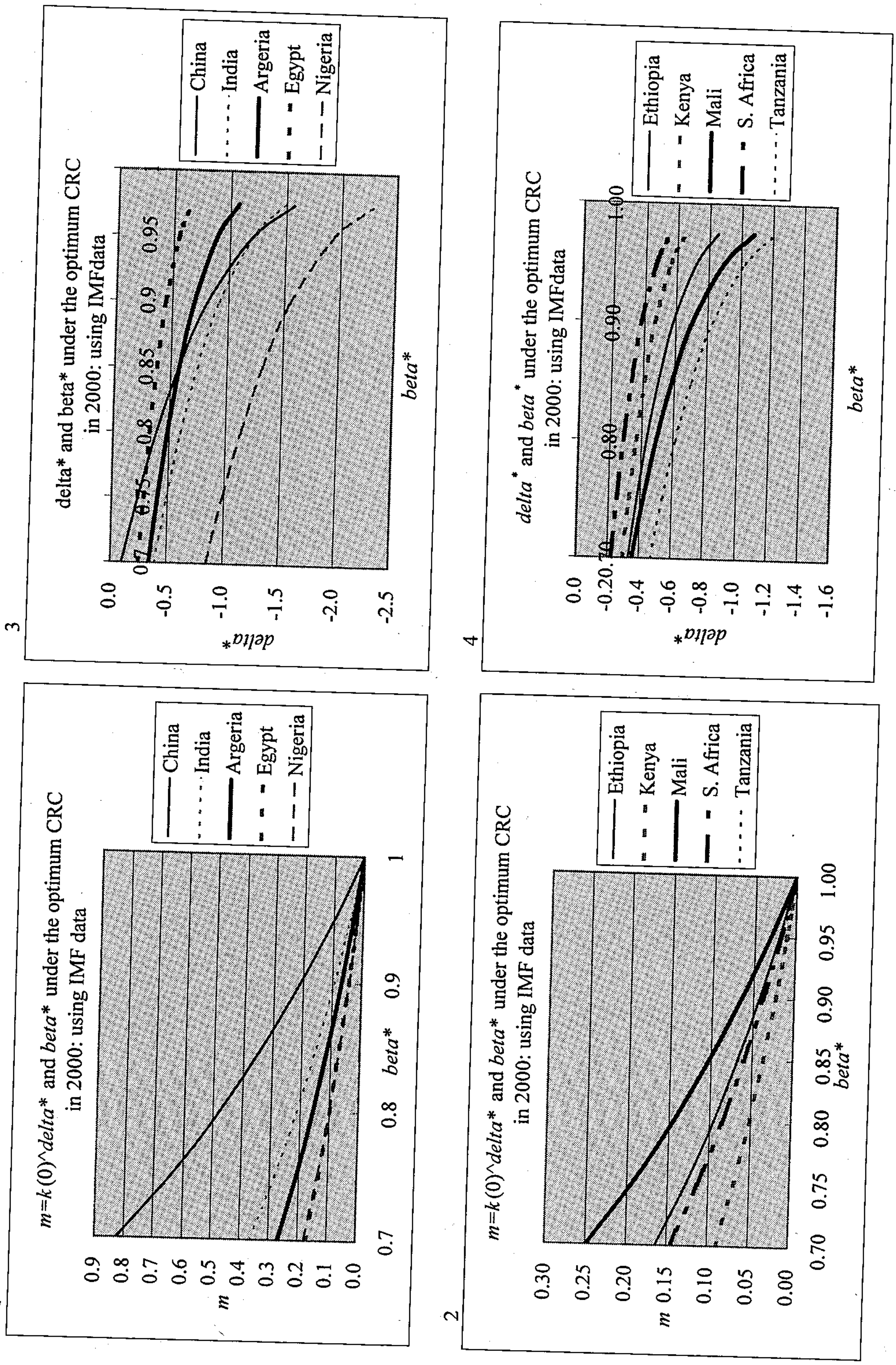


Figure 4 The relationship between *beta** and *m=k*(0)^*delta** in 2000

Table 3 The relationship between *beta** and *m=k*(0)^*delta** in 1996 (1)

*beta**	*m* China	India	Argeria	Egypt	Ethiopia	Kenya	Mali	Nigeria	S. Africa	Tanzania
0.7	0.3511	0.2648	0.1708	0.7971	0.2184	0.0899	0.3255	0.1475	0.1024	0.1760
0.75	0.2725	0.2048	0.1322	0.4921	0.1660	0.0692	0.2497	0.1148	0.0804	0.1315
0.8	0.2040	0.1528	0.0988	0.3127	0.1221	0.0514	0.1851	0.0861	0.0608	0.0954
0.85	0.1438	0.1074	0.0695	0.1945	0.0847	0.0360	0.1293	0.0608	0.0433	0.0655
0.9	0.0904	0.0674	0.0436	0.1108	0.0526	0.0225	0.0807	0.0383	0.0274	0.0402
0.950	0.0428	0.0318	0.0206	0.0483	0.0246	0.0106	0.0379	0.0181	0.0131	0.0186
0.975	0.0208	0.0155	0.0100	0.0227	0.0119	0.0051	0.0184	0.0088	0.0064	0.0090
1.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 4 The relationship between *beta** and *delta** in 1996 (1)

*beta**	*delta** China	India	Argeria	Egypt	Ethiopia	Kenya	Mali	Nigeria	S. Africa	Tanzania
0.7	-1.2034	-0.8786	-0.6028	-0.0338	-0.0338	-0.3255	-0.2945	-1.1087	-0.2914	-0.5971
0.75	-1.4947	-1.0485	-0.6902	-0.1058	-0.1058	-0.3609	-0.3641	-1.2541	-0.3223	-0.6971
0.8	-1.8275	-1.2420	-0.7897	-0.1735	-0.1735	-0.4011	-0.4427	-1.4206	-0.3580	-0.8074
0.85	-2.2298	-1.4751	-0.9097	-0.2444	-0.2444	-0.4493	-0.5369	-1.6223	-0.4015	-0.9369
0.9	-2.7633	-1.7835	-1.0686	-0.3285	-0.3285	-0.5127	-0.6607	-1.8902	-0.4598	-1.1044
0.950	-3.6237	-2.2798	-1.3245	-0.4522	-0.4522	-0.6146	-0.8589	-2.3230	-0.5546	-1.3686
0.975	-4.4511	-2.7563	-1.5702	-0.5649	-0.5649	-0.7122	-1.0486	-2.7396	-0.6461	-1.6191
1.000	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
$beta^*_{delta=0}$	0.4545	0.3978	0.3048	0.6790	0.4055	0.2363	0.4602	0.2545	0.1259	0.4139
$g_A(t)$	0.1437	0.1079	0.0957	0.0064	0.0361	0.0533	0.0276	0.0573	0.0438	0.0150

Table 3 The relationship between *beta** and *m*=*k*(0)^*delta** by country in 2000 (2)

*beta** \ *m*	China	India	Argeria	Egypt	Ethiopia	Kenya	Mali	Nigeria	S. Africa	Tanzania
0.7	0.8248	0.3649	0.2680	0.1718	0.1643	0.0892	0.2487	0.1793	0.1459	0.1639
0.75	0.6383	0.2838	0.2085	0.1336	0.1278	0.0693	0.1935	0.1366	0.1135	0.1275
0.8	0.4767	0.2128	0.1563	0.1002	0.0958	0.0520	0.1451	0.1007	0.0851	0.0956
0.85	0.3352	0.1502	0.1104	0.0708	0.0676	0.0367	0.1024	0.0700	0.0601	0.0675
0.9	0.2103	0.0946	0.0695	0.0445	0.0426	0.0231	0.0645	0.0435	0.0378	0.0425
0.950	0.0993	0.0448	0.0329	0.0211	0.0202	0.0109	0.0305	0.0204	0.0179	0.0201
0.975	0.0483	0.0218	0.0160	0.0103	0.0098	0.0053	0.0149	0.0099	0.0087	0.0098
1.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 4 The relationship between *beta** and *delta** by country in 2000 (2)

*beta** \ *delta**	China	India	Argeria	Egypt	Ethiopia	Kenya	Mali	Nigeria	S. Africa	Tanzania
0.3	0.8352	0.2994	0.0982	-0.0094	-0.0207	-0.0901	0.0780	-0.1640	-0.0268	-0.0299
0.7	-0.1001	-0.3908	-0.3421	-0.2484	-0.3351	-0.3013	-0.3580	-0.8489	-0.2246	-0.4755
0.75	-0.2333	-0.4882	-0.4074	-0.2838	-0.3817	-0.3326	-0.4226	-0.9831	-0.2540	-0.5415
0.8	-0.3851	-0.5997	-0.4822	-0.3244	-0.4351	-0.3685	-0.4966	-1.1338	-0.2876	-0.6172
0.85	-0.5681	-0.7347	-0.5727	-0.3735	-0.4997	-0.4119	-0.5862	-1.3133	-0.3282	-0.7088
0.9	-0.8104	-0.9140	-0.6929	-0.4387	-0.5856	-0.4696	-0.7052	-1.5483	-0.3822	-0.8304
0.950	-1.2003	-1.2036	-0.8871	-0.5441	-0.7242	-0.5627	-0.8975	-1.9231	-0.4694	-1.0269
0.975	-1.5748	-1.4823	-1.0739	-0.6455	-0.8576	-0.6523	-1.0825	-2.2809	-0.5534	-1.2159
1.000	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
$beta^*_{delta=0}$	0.6591	0.4599	0.3848	0.2862	0.2771	0.1722	0.3672	0.2351	0.2540	0.2767
$g_A(t)$	0.0940	0.0862	0.0422	0.0616	0.0213	(0.0010)	0.0276	0.0441	0.0158	0.0222

Table 5 Comparison of the Penrose effect whose slope B/A shows 1.0 (as the minimum limit of 45°)

For convergence to CRC*, $\Omega^*=(\beta^* s(1-\alpha))/(s(1-\beta^*)(1+n)+n(1-\alpha))$ is used.

China 2000

n	$\beta^*_{delta=0}$	$s\rightarrow i$	Ω^*	alpha	r_M
0.008144	0.659099	0.273790	1.634240	0.08	

If δ=0, 0.6590989 (count backward by Eq.)
By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)
0.5	0.8656	0.3163	0.1369	2.3106	0.0924	0.04000	2.3106	1.0000	104.0
0.6	1.2819	0.2136	0.1095	1.9503	0.0624	0.03200	1.9503	1.0000	87.8
0.7	1.9527	0.1402	0.0821	1.7071	0.0410	0.02400	1.7071	1.0000	76.8
0.8	3.2141	0.0852	0.0548	1.5557	0.0249	0.01600	1.5557	1.0000	70.0
0.9	6.4597	0.0424	0.0274	1.5481	0.0124	0.00800	1.5481	1.0000	69.7
1	33.6203	0.0081	0.0000	#DIV/0!	0.0024	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.05	-41.9220	-0.0065	-0.0137	*0.4771*	-0.0019	-0.00400	0.4771	1.0000	*21.5*
1.1	-13.7781	-0.0199	-0.0274	*0.7258*	-0.0058	-0.00800	0.7258	1.0000	*32.7*
1.2	-6.3352	-0.0432	-0.0548	*0.7892*	-0.0126	-0.01600	0.7892	1.0000	*35.5*
1.3	-4.3478	-0.0630	-0.0821	*0.7667*	-0.0184	-0.02400	0.7667	1.0000	*34.5*

Nigeria 2000

n	$\beta^*_{delta=0}$	$s\rightarrow i$	Ω^*	alpha	r_M
0.039423	0.367347	0.069709	0.292069	0.05	

If δ=0, 0.367347 (count backward by Eq.)
By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)
0.5	0.4494	0.1551	0.0349	4.4504	0.1113	0.02500	4.4504	1.0000	200.3
0.6	0.5981	0.1166	0.0279	4.1799	0.0836	0.02000	4.1799	1.0000	188.1
0.7	0.7832	0.0890	0.0209	4.2561	0.0638	0.01500	4.2561	1.0000	191.5
0.8	1.0199	0.0683	0.0139	4.9022	0.0490	0.01000	4.9022	1.0000	220.6
0.9	1.3334	0.0523	0.0070	7.4994	0.0375	0.00500	7.4994	1.0000	337.5
1	1.7682	0.0394	0.0000	#DIV/0!	0.0283	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.05	2.0555	0.0339	-0.0035	*-9.7300*	0.0243	-0.00250	-9.7300	1.0000	*(437.9)*
1.1	2.4116	0.0289	-0.0070	*-4.1466*	0.0207	-0.00500	-4.1466	1.0000	*(186.6)*
1.2	3.4611	0.0201	-0.0139	*-1.4446*	0.0144	-0.01000	-1.4446	1.0000	*(65.0)*
1.3	5.4784	0.0127	-0.0209	*-0.6084*	0.0091	-0.01500	-0.6084	1.0000	*(27.4)*

Tanzania 2000

n	$\beta^*_{delta=0}$	$s\rightarrow i$	Ω^*	alpha	r_M
0.024205	0.440501	0.039736	0.363345	0.05	

If δ=0, 0.4405013 (count backward by Eq.)
By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)
0.5	0.4355	0.0913	0.0199	4.5928	0.1148	0.02500	4.5928	1.0000	206.7
0.6	0.5767	0.0689	0.0159	4.3350	0.0867	0.02000	4.3350	1.0000	195.1
0.7	0.7506	0.0529	0.0119	4.4409	0.0666	0.01500	4.4409	1.0000	199.8
0.8	0.9700	0.0410	0.0079	5.1548	0.0515	0.01000	5.1548	1.0000	232.0
0.9	1.2553	0.0317	0.0040	7.9662	0.0398	0.00500	7.9662	1.0000	358.5
1	1.6416	0.0242	0.0000	#DIV/0!	0.0305	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.05	1.8911	0.0210	-0.0020	*-10.5760*	0.0264	-0.00250	-10.5760	1.0000	*(475.9)*
1.1	2.1941	0.0181	-0.0040	*-4.5576*	0.0228	-0.00500	-4.5576	1.0000	*(205.1)*
1.2	3.0494	0.0130	-0.0079	*-1.6397*	0.0164	-0.01000	-1.6397	1.0000	*(73.8)*
1.3	4.5500	0.0087	-0.0119	*-0.7326*	0.0110	-0.01500	-0.7326	1.0000	*(33.0)*

Notes:
1. The investment ratio to capital I/K is distinguished from the rate of saving s or the investment ratio to output $i=I/Y$.
2. I/K is that after depreciation. If there is no banking costs (with θ_1=1), the rate of saving s equals $i=I/Y$.
3. When the slope B is 1.0 with 45°, it shows a minimum limit of equilibrium.
4. Convergence and equilibrium hold only when the slope B equals the slope A: each right-angled triangle is similar.
5. When $beta^*$ becomes closer to 1.0, the convergence to CRC is difficult to attain.
Whne $beta^*$ is above 1.0, the slope B is negative with a vertical asymptoto at $beta^*$=1.0.

Table 6 Comparison of the Penrose effect whose market rate r_M of interest is fixed

China 2000

For convergence to CRC*, $\Omega^*=(\beta^* s(1-\alpha))/(s(1-\beta^*)(1+n)+n(1-\alpha)$ is used.

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	*alpha*	r_M
0.008144	0.659099	0.273790	1.634240	0.08	0.0324

By **fixing** the market rate, r_M:

If *beta** is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.8656	0.3163	0.1369	2.3106	0.0924	0.0324	2.8526	0.8100	104.0
0.6	1.2819	0.2136	0.1095	1.9503	0.0624	0.0324	1.9262	1.0125	87.8
0.7	1.9527	0.1402	0.0821	1.7071	0.0410	0.0324	1.2645	1.3500	76.8
0.8	3.2141	0.0852	0.0548	1.5557	0.0249	0.0324	0.7682	2.0250	70.0
0.9	6.4597	0.0424	0.0274	1.5481	0.0124	0.0324	0.3822	4.0500	69.7
1	33.6203	0.0081	0.0000	#DIV/0!	0.0024	0.0324	0.0734	#DIV/0!	#DIV/0!
1.05	-41.9220	-0.0065	-0.0137	*0.4771*	-0.0019	0.0324	-0.0589	-8.1000	*21.5*
1.1	-13.7781	-0.0199	-0.0274	*0.7258*	-0.0058	0.0324	-0.1792	-4.0500	*32.7*
1.2	-6.3352	-0.0432	-0.0548	*0.7892*	-0.0126	0.0324	-0.3897	-2.0250	*35.5*
1.3	-4.3478	-0.0630	-0.0821	*0.7667*	-0.0184	0.0324	-0.5679	-1.3500	*34.5*

Nigeria 2000

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	*alpha*	r_M
0.039423	0.367347	0.069709	0.292069	0.05	0.14

By **fixing** the market rate, r_M:

If *beta** is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.4494	0.1551	0.0349	4.4504	0.1113	0.14	0.7947	5.6000	200.3
0.6	0.5981	0.1166	0.0279	4.1799	0.0836	0.14	0.5971	7.0000	188.1
0.7	0.7832	0.0890	0.0209	4.2561	0.0638	0.14	0.4560	9.3333	191.5
0.8	1.0199	0.0683	0.0139	4.9022	0.0490	0.14	0.3502	14.0000	220.6
0.9	1.3334	0.0523	0.0070	7.4994	0.0375	0.14	0.2678	28.0000	337.5
1	1.7682	0.0394	0.0000	#DIV/0!	0.0283	0.14	0.2020	#DIV/0!	#DIV/0!
1.05	2.0555	0.0339	-0.0035	*-9.7300*	0.0243	0.14	0.1738	-56.0000	*(437.9)*
1.1	2.4116	0.0289	-0.0070	*-4.1466*	0.0207	0.14	0.1481	-28.0000	*(186.6)*
1.2	3.4611	0.0201	-0.0139	*-1.4446*	0.0144	0.14	0.1032	-14.0000	*(65.0)*
1.3	5.4784	0.0127	-0.0209	*-0.6084*	0.0091	0.14	0.0652	-9.3333	*(27.4)*

Tanzania 2000

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	*alpha*	r_M
0.024205	0.440501	0.039736	0.363345	0.05	0.107

By **fixing** the market rate, r_M:

If *beta** is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.4355	0.0913	0.0199	4.5928	0.1148	0.107	1.0731	4.2800	206.7
0.6	0.5767	0.0689	0.0159	4.3350	0.0867	0.107	0.8103	5.3500	195.1
0.7	0.7506	0.0529	0.0119	4.4409	0.0666	0.107	0.6226	7.1333	199.8
0.8	0.9700	0.0410	0.0079	5.1548	0.0515	0.107	0.4818	10.7000	232.0
0.9	1.2553	0.0317	0.0040	7.9662	0.0398	0.107	0.3723	21.4000	358.5
1	1.6416	0.0242	0.0000	#DIV/0!	0.0305	0.107	0.2846	#DIV/0!	#DIV/0!
1.05	1.8911	0.0210	-0.0020	-10.5760	0.0264	0.107	0.2471	-42.8000	*(475.9)*
1.1	2.1941	0.0181	-0.0040	-4.5576	0.0228	0.107	0.2130	-21.4000	*(205.1)*
1.2	3.0494	0.0130	-0.0079	-1.6397	0.0164	0.107	0.1532	-10.7000	*(73.8)*
1.3	4.5500	0.0087	-0.0119	-0.7326	0.0110	0.107	0.1027	-7.1333	*(33.0)*

Notes:

1. We must pay attention to *beta** at the slope B=1.0 (or 45°) as a base.
2. For convegence to CRC*, the capital-output ratio and the slope B change along with the change in *beta**.
3. The higher the market rate the higher the slope B/A.
4. When the Central Bank does not take any action to the offical rate, the slope B/A changes with the change in *beta**.

Appendix 1 Measurement of the Penrose effect using case study

Case A

$\beta^*_{delta=0}$	$s\to i$	Ω^*	alpha	r_M
0.8	0.12	3	0.1	0.02

$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)	Angle A (°)
0.04	0.024	1.6667	0.0333	0.02	1.6667	1	75	75

If $beta^*$ is:	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)	Angle A (°)
0.5	0.04	0.06	0.6667	0.0333	0.02	1.6667	0.4	30	75
0.6	0.04	0.048	0.8333	0.0333	0.02	1.6667	0.5	37.5	75
0.7	0.04	0.036	1.1111	0.0333	0.02	1.6667	0.66667	50	75
0.8	0.04	0.024	1.6667	0.0333	0.02	1.6667	1	75	75
0.9	0.04	0.012	3.3333	0.0333	0.02	1.6667	2	150	75
1	0.04	0	#DIV/0!	0.0333	0.02	1.6667	#DIV/0!	#DIV/0!	75
1.05	0.04	-0.006	-6.6667	0.0333	0.02	1.6667	-4	-300	75
1.1	0.04	-0.012	-3.3333	0.0333	0.02	1.6667	-2	-150	75
1.2	0.04	-0.024	-1.6667	0.0333	0.02	1.6667	-1	-75	75
1.3	0.04	-0.036	-1.1111	0.0333	0.02	1.6667	-0.66667	-50	75
1.4	0.04	-0.048	-0.8333	0.0333	0.02	1.6667	-0.5	-37.5	75
1.5	0.04	-0.06	-0.6667	0.0333	0.02	1.6667	-0.4	-30	75

$beta^*$ is independent of i or s.
Ω^* varies along with the change in $beta^*$.
Slope B=$I/K/g_A^*$

n	$\beta^*_{delta=0}$	$s\to i$	Ω^*	alpha	r_M
0.0051906	0.8	0.12	3.000401	0.1	0.02

Case B $\Omega^*=(\beta^* s(1-\alpha))/(s(1-\beta^*)(1+n)+n(1-\alpha))$

By **fixing** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.8310	0.1444	0.0600	2.4068	0.1203	0.02	6.0169	0.4000	108.3
0.6	1.2245	0.0980	0.0480	2.0417	0.0817	0.02	4.0834	0.5000	91.9
0.7	1.8503	0.0649	0.0360	1.8015	0.0540	0.02	2.7023	0.6667	81.1
0.8	3.0004	0.0400	0.0240	1.6664	0.0333	0.02	1.6664	1.0000	75.0
0.9	5.8086	0.0207	0.0120	1.7216	0.0172	0.02	0.8608	2.0000	77.5
1	23.1185	0.0052	0.0000	#DIV/0!	0.0043	0.02	0.2163	#DIV/0!	#DIV/0!
1.05	-83.4088	-0.0014	-0.0060	0.2398	-0.0012	0.02	-0.0599	-4.0000	10.8
1.1	-16.0742	-0.0075	-0.0120	0.6221	-0.0062	0.02	-0.3111	-2.0000	28.0
1.2	-6.6622	-0.0180	-0.0240	0.7505	-0.0150	0.02	-0.7505	-1.0000	33.8
1.3	-4.4550	-0.0269	-0.0360	0.7482	-0.0224	0.02	-1.1223	-0.6667	33.7

Case C $\Omega^*=(\beta^* s(1-\alpha))/(s(1-\beta^*)(1+n)+n(1-\alpha))$

By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.8310	0.1444	0.0600	2.4068	0.1203	0.05	2.4068	1.0000	108.3
0.6	1.2245	0.0980	0.0480	2.0417	0.0817	0.04	2.0417	1.0000	91.9
0.7	1.8503	0.0649	0.0360	1.8015	0.0540	0.03	1.8015	1.0000	81.1
0.8	3.0004	0.0400	0.0240	1.6664	0.0333	0.02	1.6664	1.0000	75.0
0.9	5.8086	0.0207	0.0120	1.7216	0.0172	0.01	1.7216	1.0000	77.5
1	23.1185	0.0052	0.0000	#DIV/0!	0.0043	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.05	-83.4088	-0.0014	-0.0060	0.2398	-0.0012	-0.005	0.2398	1.0000	10.8
1.1	-16.0742	-0.0075	-0.0120	0.6221	-0.0062	-0.01	0.6221	1.0000	28.0
1.2	-6.6622	-0.0180	-0.0240	0.7505	-0.0150	-0.02	0.7505	1.0000	33.8
1.3	-4.4550	-0.0269	-0.0360	0.7482	-0.0224	-0.03	0.7482	1.0000	33.7

Notes:
Two points B (for the investment ratio) and A (for the rate of profit) correspond with Uzawa [1969, p.640],
but, the growth rate of capital is replaced by an endogenous rate of technological progress.

For Point B: $I/K=s/\Omega^*$
$g_A^*=(1-\beta^*)s=(1-\beta^*)(s/\Omega^*)\Omega^*$

Slope B: $(I/K)/g_A^*=1/((1-\beta^*)\Omega^*)$
Angle B: The slope B multiplied by 45

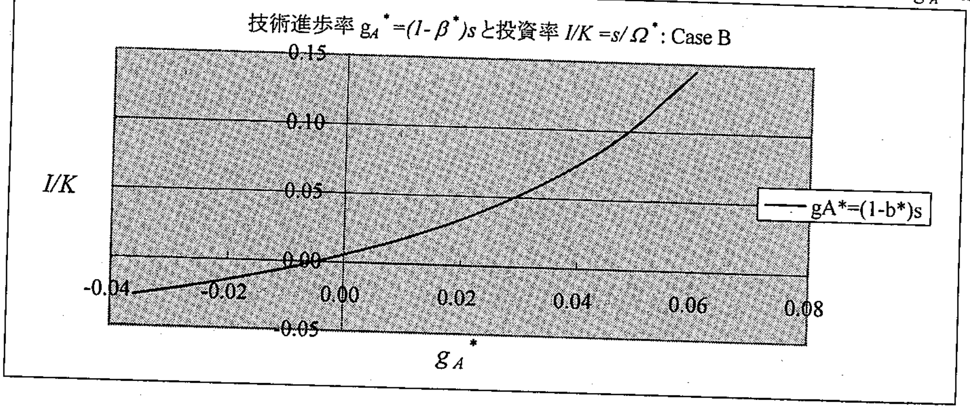
For Point A: $r^*=\alpha/\Omega^*=(\alpha/s)(s/\Omega^*)$
r_M is given in the market

Slope A: $r^*/r_M=(\alpha/s)(s/\Omega^*)/r_M$
Slope B/A Slope B÷Slope A

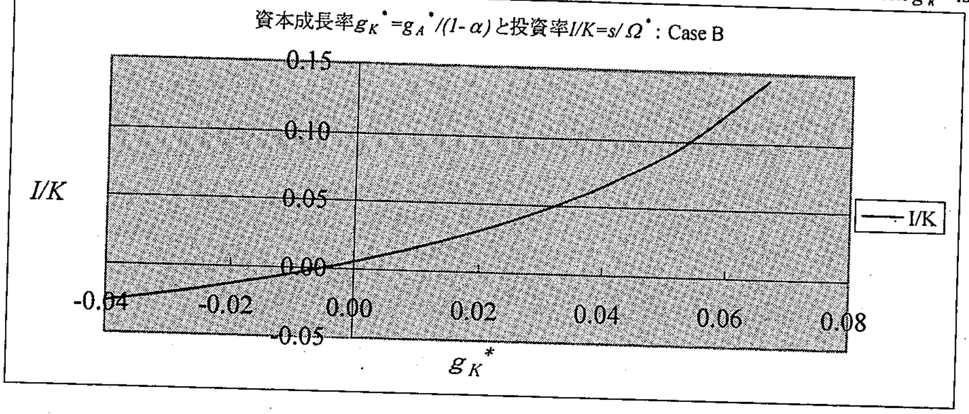
The value of r_M can be calculated so that Slope B equals Slope A in a limit equilibrium.

Appendix 2 Graphic expression of the Penrose effect using case study (1)

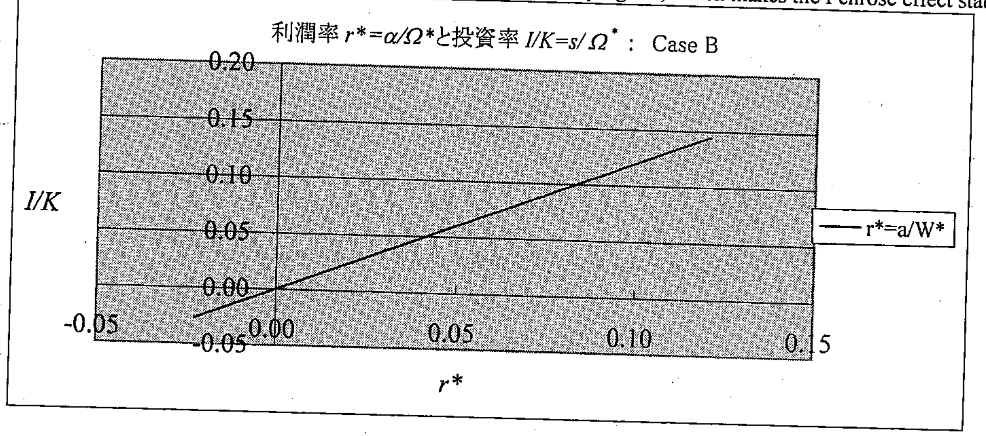
Corresponding with Uzawa's [1964] Penrose curve when $g_A{}^*$ is used



Corresponding with Uzawa's [1964] Penrose curve when $g_k{}^*$ is used

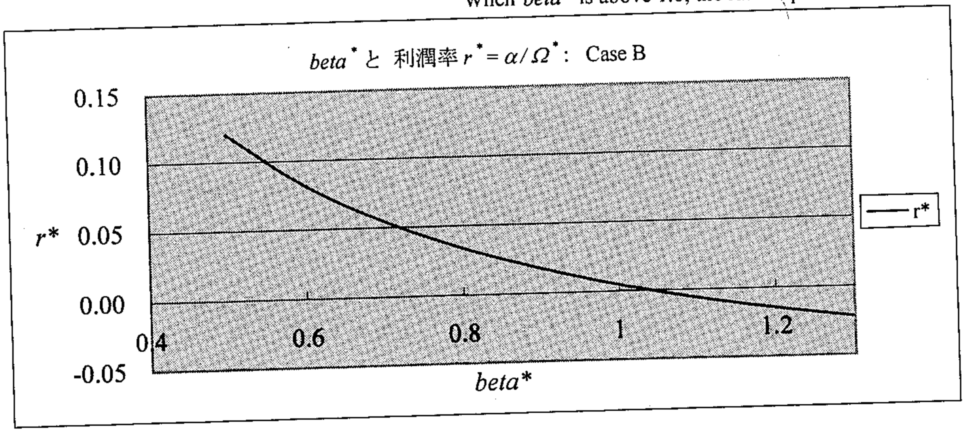


The investment ratio I/K is linearly related to the rate of tch.progress, which makes the Penrose effect stable.

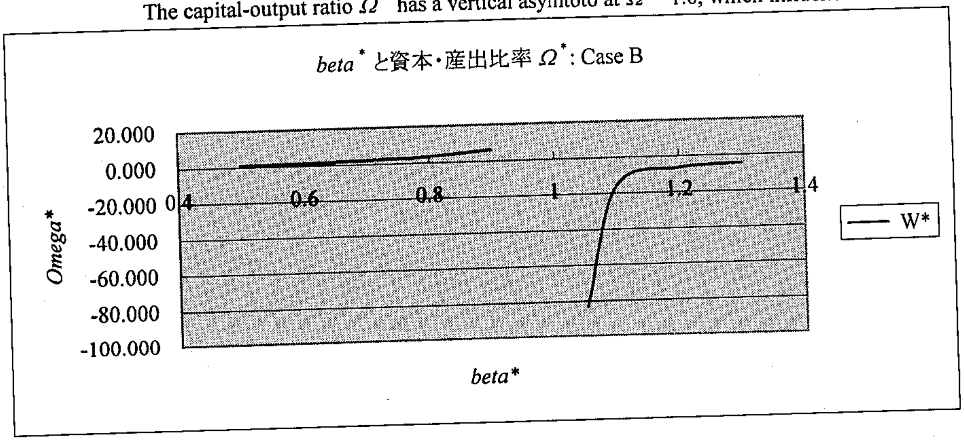


Appendix 3 Graphic expression of the Penrose effect using case study (2)

When $beta^*$ is above 1.0, the rate of profit becomes negative.



The capital-output ratio Ω^* has a vertical asymtoto at Ω^*=1.0, which influences other variables.



The rate of tech.progress is linearly realted to $beta^*$, which makes the Penrose effect stable.

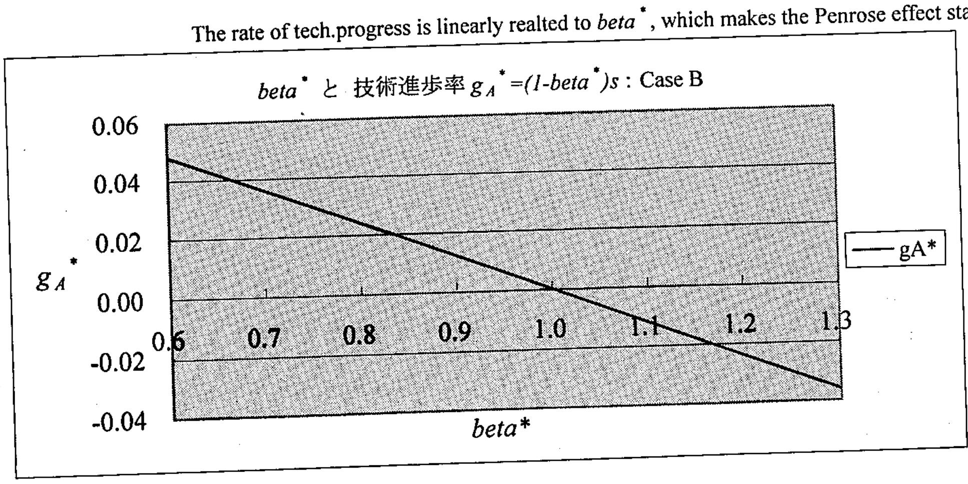


Table 7 Comparison of the Penrose effect whose slope B/A shows 1.0 (as the minimum limit of 45°)

China 2000

For convergence to CRC*, $\Omega^*=(\beta^* s(1-\alpha))/(s(1-\beta^*)(1+n)+n(1-\alpha))$ is used.

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.008144	0.659099	0.273790	1.634240	0.08	

If δ=0, 0.6590989 (count backward by Eq.)
By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.8656	0.3163	0.1369	2.3106	0.0924	0.04000	2.3106	1.0000	104.0
0.6	1.2819	0.2136	0.1095	1.9503	0.0624	0.03200	1.9503	1.0000	87.8
0.7	1.9527	0.1402	0.0821	1.7071	0.0410	0.02400	1.7071	1.0000	76.8
0.8	3.2141	0.0852	0.0548	1.5557	0.0249	0.01600	1.5557	1.0000	70.0
0.9	6.4597	0.0424	0.0274	1.5481	0.0124	0.00800	1.5481	1.0000	69.7
1	33.6203	0.0081	0.0000	#DIV/0!	0.0024	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

China 2000: *s* or *i* changes (1)

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.008144	0.659099	0.140000	1.634240	0.08	

If δ=0, 0.675744 (count backward by Eq.)
By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.8250	0.1697	0.0700	2.4243	0.0970	0.04000	2.4243	1.0000	109.1
0.6	1.2085	0.1158	0.0560	2.0687	0.0662	0.03200	2.0687	1.0000	93.1
0.7	1.8092	0.0774	0.0420	1.8424	0.0442	0.02400	1.8424	1.0000	82.9
0.8	2.8846	0.0485	0.0280	1.7333	0.0277	0.01600	1.7333	1.0000	78.0
0.9	5.3652	0.0261	0.0140	1.8639	0.0149	0.00800	1.8639	1.0000	83.9
1	17.1915	0.0081	0.0000	#DIV/0!	0.0047	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

China 2000: *s* or *i* changes (2)

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.008144	0.659099	0.040000	1.634240	0.08	

If δ=0, 0.7608992 (count backward by Eq.)
By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.6653	0.0601	0.0200	3.0060	0.1202	0.04000	3.0060	1.0000	135.3
0.6	0.9347	0.0428	0.0160	2.6746	0.0856	0.03200	2.6746	1.0000	120.4
0.7	1.3150	0.0304	0.0120	2.5349	0.0608	0.02400	2.5349	1.0000	114.1
0.8	1.8924	0.0211	0.0080	2.6422	0.0423	0.01600	2.6422	1.0000	118.9
0.9	2.8738	0.0139	0.0040	3.4797	0.0278	0.00800	3.4797	1.0000	156.6
1	4.9118	0.0081	0.0000	#DIV/0!	0.0163	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

China 2000: *n* changes (1)

For convergence to CRC*, $\Omega^*=(\beta^* s(1-$

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.020000	0.659099	0.273790	1.634240	0.08	

If δ=0, 0.6868207 (count backward by Eq.)
By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.7969	0.3435	0.1369	2.5096	0.1004	0.04000	2.5096	1.0000	112.9
0.6	1.1616	0.2357	0.1095	2.1522	0.0689	0.03200	2.1522	1.0000	96.8
0.7	1.7256	0.1587	0.0821	1.9317	0.0464	0.02400	1.9317	1.0000	86.9
0.8	2.7138	0.1009	0.0548	1.8424	0.0295	0.01600	1.8424	1.0000	82.9
0.9	4.8935	0.0559	0.0274	2.0435	0.0163	0.00800	2.0435	1.0000	92.0
1	13.6895	0.0200	0.0000	#DIV/0!	0.0058	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

China 2000: *n* changes (2)

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.030000	0.659099	0.273790	1.634240	0.08	

If δ=0, 0.7098812 (count backward by Eq.)
By **adjusting** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	**Slope B/A**	Angle B (°)
0.5	0.7470	0.3665	0.1369	2.6774	0.1071	0.04000	2.6774	1.0000	120.5
0.6	1.0764	0.2544	0.1095	2.3225	0.0743	0.03200	2.3225	1.0000	104.5
0.7	1.5715	0.1742	0.0821	2.1212	0.0509	0.02400	2.1212	1.0000	95.5
0.8	2.3989	0.1141	0.0548	2.0843	0.0333	0.01600	2.0843	1.0000	93.8
0.9	4.0627	0.0674	0.0274	2.4614	0.0197	0.00800	2.4614	1.0000	110.8
1	9.1263	0.0300	0.0000	#DIV/0!	0.0088	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Table 8 Comparison of the Penrose effect whose market rate r_M of interest is fixed

Tanzania 2000

For convergence to CRC*, $\Omega^*=(\beta^* s(1-\alpha))/(s(1-\beta^*)(1+n)+n(1-\alpha))$ is used.

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.024205	0.440501	0.039736	0.363345	0.05	

If δ=0, 0.4405013 (count backward by Eq.)
By **fixing** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)
0.5	0.4355	0.0913	0.0199	4.5928	0.1148	0.02500	4.5928	1.0000	206.7
0.6	0.5767	0.0689	0.0159	4.3350	0.0867	0.02000	4.3350	1.0000	195.1
0.7	0.7506	0.0529	0.0119	4.4409	0.0666	0.01500	4.4409	1.0000	199.8
0.8	0.9700	0.0410	0.0079	5.1548	0.0515	0.01000	5.1548	1.0000	232.0
0.9	1.2553	0.0317	0.0040	7.9662	0.0398	0.00500	7.9662	1.0000	358.5
1	1.6416	0.0242	0.0000	#DIV/0!	0.0305	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Tanzania 2000: *s* or *i* changes (1)

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.024205	0.440501	0.100000	0.363345	0.05	

If δ=0, 0.3446621 (count backward by Eq.)
By **fixing** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)
0.5	0.6401	0.1562	0.0500	3.1244	0.0781	0.02500	3.1244	1.0000	140.6
0.6	0.8911	0.1122	0.0400	2.8054	0.0561	0.02000	2.8054	1.0000	126.2
0.7	1.2379	0.0808	0.0300	2.6928	0.0404	0.01500	2.6928	1.0000	121.2
0.8	1.7480	0.0572	0.0200	2.8605	0.0286	0.01000	2.8605	1.0000	128.7
0.9	2.5724	0.0389	0.0100	3.8874	0.0194	0.00500	3.8874	1.0000	174.9
1	4.1313	0.0242	0.0000	#DIV/0!	0.0121	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Tanzania 2000: *s* or *i* changes (2)

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.024205	0.440501	0.150000	0.363345	0.05	0.107

If δ=0, 0.3235974 (count backward by Eq.)
By **fixing** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)
0.5	0.7139	0.2101	0.0750	2.8017	0.0700	0.02500	2.8017	1.0000	126.1
0.6	1.0125	0.1482	0.0600	2.4692	0.0494	0.02000	2.4692	1.0000	111.1
0.7	1.4439	0.1039	0.0450	2.3086	0.0346	0.01500	2.3086	1.0000	103.9
0.8	2.1221	0.0707	0.0300	2.3562	0.0236	0.01000	2.3562	1.0000	106.0
0.9	3.3435	0.0449	0.0150	2.9909	0.0150	0.00500	2.9909	1.0000	134.6
1	6.1970	0.0242	0.0000	#DIV/0!	0.0081	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

$\alpha))/(s(1-\beta^*)(1+n)+n(1-\alpha)$ is used.

Tanzania 2000: *n* changes (1)

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.010000	0.440501	0.039736	0.363345	0.05	0.107

If δ=0, 0.3446113 (count backward by Eq.)
By **fixing** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)
0.5	0.6384	0.0622	0.0199	3.1329	0.0783	0.02500	3.1329	1.0000	141.0
0.6	0.8864	0.0448	0.0159	2.8205	0.0564	0.02000	2.8205	1.0000	126.9
0.7	1.2268	0.0324	0.0119	2.7172	0.0408	0.01500	2.7172	1.0000	122.3
0.8	1.7231	0.0231	0.0079	2.9018	0.0290	0.01000	2.9018	1.0000	130.6
0.9	2.5141	0.0158	0.0040	3.9775	0.0199	0.00500	3.9775	1.0000	179.0
1	3.9736	0.0100	0.0000	#DIV/0!	0.0126	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Tanzania 2000: *n* changes (2)

n	$\beta^*_{delta=0}$	$s \to i$	Ω^*	alpha	r_M
0.035000	0.440501	0.039736	0.363345	0.05	0.107

If δ=0, 0.5128695 (count backward by Eq.)
By **fixing** the market rate, r_M:

If $beta^*$ is:	then, Ω^*	$I/K=s/\Omega^*$	$g_A^*=(1-\beta^*)s$	Slope B	$r^*=\alpha/\Omega^*$	r_M	Slope A	Slope B/A	Angle B (°)
0.5	0.3507	0.1133	0.0199	5.7022	0.1426	0.02500	5.7022	1.0000	256.6
0.6	0.4557	0.0872	0.0159	5.4858	0.1097	0.02000	5.4858	1.0000	246.9
0.7	0.5796	0.0686	0.0119	5.7507	0.0863	0.01500	5.7507	1.0000	258.8
0.8	0.7281	0.0546	0.0079	6.8669	0.0687	0.01000	6.8669	1.0000	309.0
0.9	0.9093	0.0437	0.0040	10.9972	0.0550	0.00500	10.9972	1.0000	494.9
1	1.1353	0.0350	0.0000	#DIV/0!	0.0440	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

T78 F5 Penrose effect 3ps

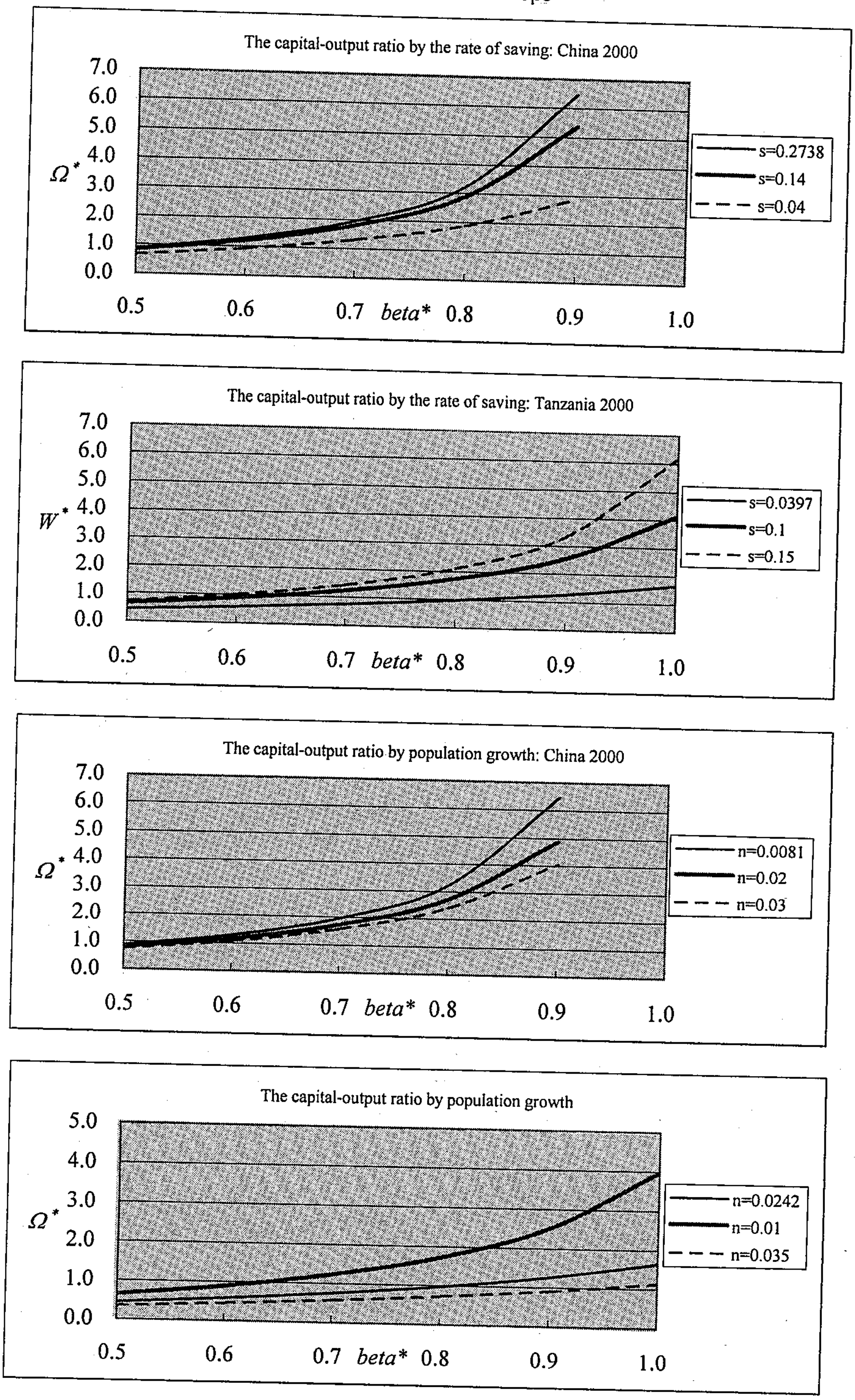


Figure 5 The capital-output ratio b y the rate of saving and population growth: China and Tanzania 2000

T78 F567 Penrose effect 5ps

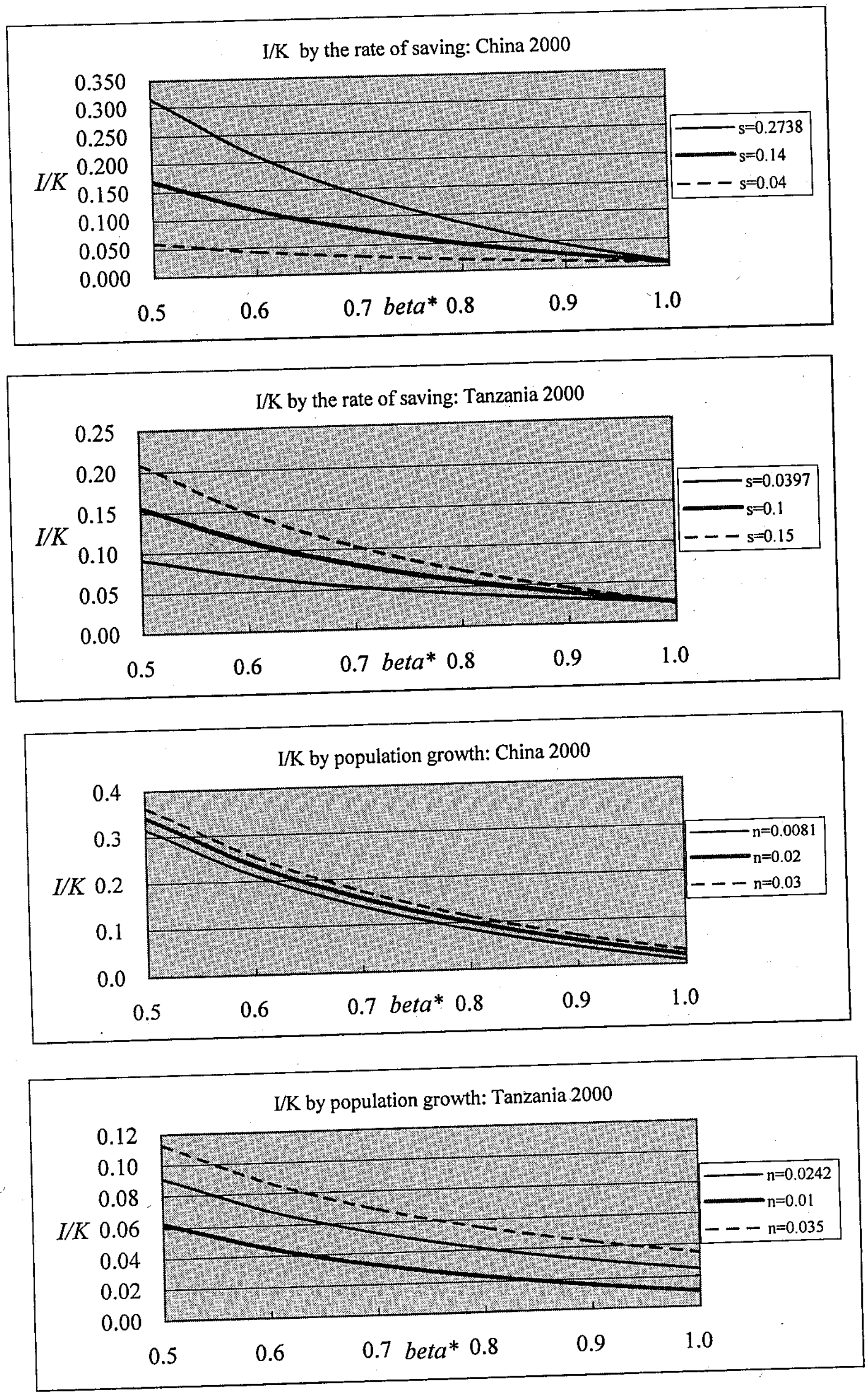


Figure 6 *I/K* by the rate of saving and population growth: China and Tanzania 2000

T78 F567 Penrose effect 5ps

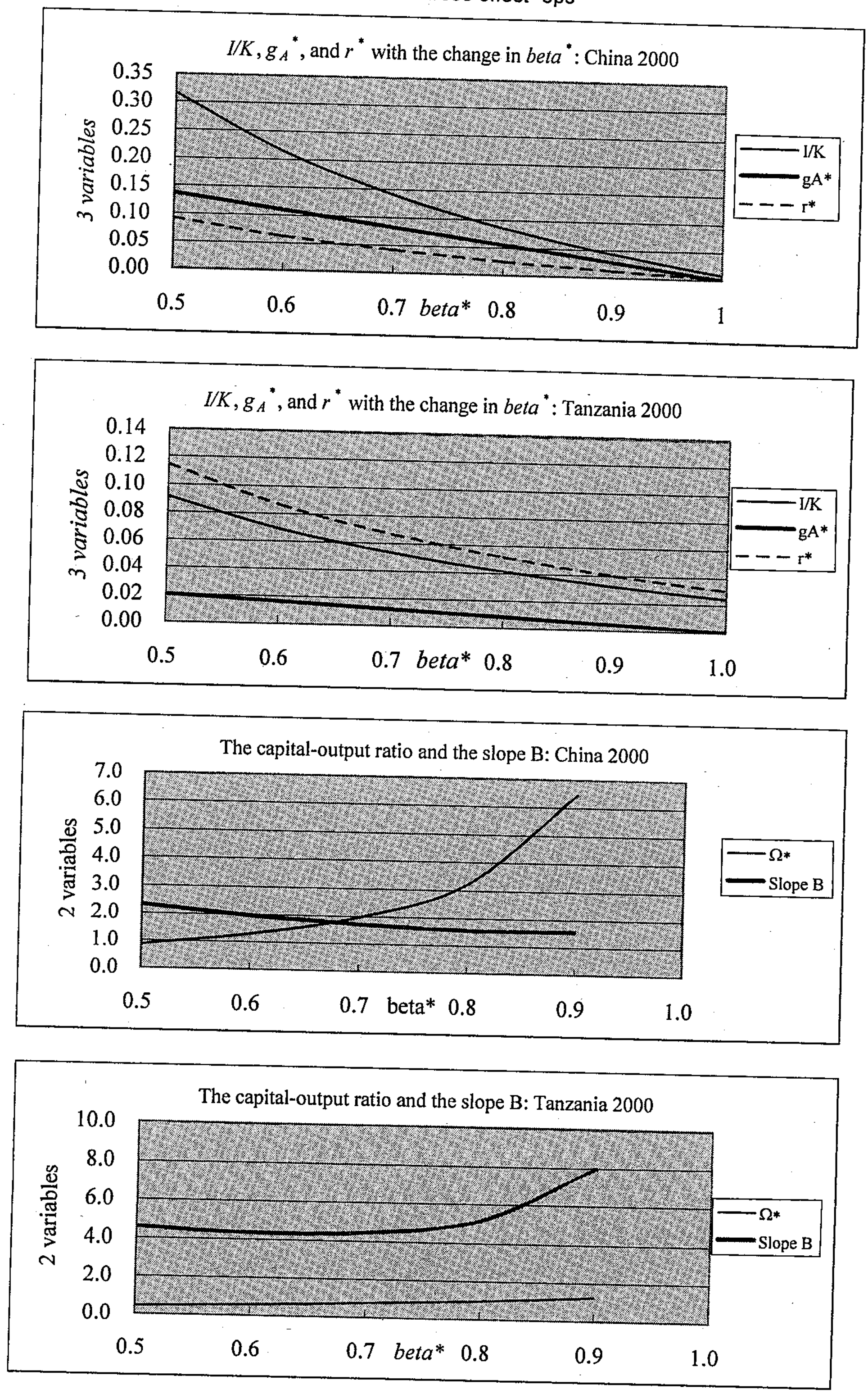


Figure 7 The relationship among variables with the change in *delta** : China and Tanzania 2000