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Appendix A-1

Import by air to Thailand for selected commodities from some specific origins

Commodity	Country	Value, Bht	
		1975	1976
(A) Fruits & Vegetables	Hong Kong	13,700	21,276
	Japan	43,538	11,407
	Germany	-	2,923
	U.S.A.	8,696	-
	Australia	12,341	-
	Other	8,410	76,775
	Total	86,685	112,381
(B) Live Fish / Animal	Hong Kong	180,561	210,576
	Japan	1,864,859	9,650,609
	France	372,807	385,470
	Germany	839,663	683,041
	U.S.A.	19,050,681	12,526,991
	Australia	21,259	100,132
	Other	7,017,828	12,975,526
	Total	29,347,658	36,532,345
(C) Flowers / Plants	Hong Kong	892	-
	Japan	89,189	40,071
	U.S.A.	-	5,835
	Other	37,897	42,650
	Total	127,978	88,556

Appendix A-1 (cont'd)

Commodity	Country	Value, DM	
		1975	1976
(D) Textiles & Textile Articles	Hong Kong	3,047,432	3,321,420
	Japan	4,682,650	6,092,545
	Saudiarabia	-	1,600
	France	296,773	627,443
	Germany	546,763	489,979
	Brazil	-	26,332
	U.S.A.	1,586,041	1,675,663
	Australia	398,447	722,618
	New Zealand	30,670	7,408
	Other	10,045,817	13,165,697
	Total	20,634,593	26,130,705
(E) Machineries & Mechanical Appliances ; Electrical Equipment , Parts there of	Hong Kong	5,872,637	6,618,731
	Japan	104,762,039	140,408,113
	France	8,732,027	12,501,384
	Germany	32,057,843	36,425,686
	Agentina	53,562	93,483
	Brazil	6,437,180	2,055,740
	U.S.A.	410,873,070	688,087,173
	Australia	8,360,457	9,699,803
	New Zealand	57,401	49,143
	Other	121,444,486	137,548,643
	Total	698,650,702	1,033,487,899

Appendix A-1 (cont'd)

Commodity	Country	Value, Bt	
		1975	1976
(F) Pharmaceuticals / Toiletries / Cosmetics	Hong Kong	281,968	368,626
	Japan	3,953,042	4,169,237
	France	3,564,105	3,734,676
	Germany	6,517,161	7,141,238
	Brazil	9,966	30,508
	U.S.A.	24,431,562	31,514,415
	Australia	8,154,003	6,221,623
	New Zealand	43,651	44,942
	Other	81,020,847	66,098,126
	Total	127,976,305	119,323,391
(G) Pearls & Precious & Semi-Precious Stones, Precious & Ralled Precious Metals & Article there of Imitation Jewelly Coin	Hong Kong	1,269,343	1,581,234
	Japan	2,908,837	829,514
	France	1,283,856	64,050
	Germany	2,301,698	1,647,483
	Brazil	523,733	2,687,343
	U.S.A.	2,520,822	8,528,307
	Australia	42,754,154	42,756,833
	Other	14,489,745	10,217,777
	Total	68,052,188	68,312,541

Appendix A-1 (cont'd)

Commodity	Country	Value, M$	
		1975	1976
(H) Foodstuffs ; Meat , Fish and Chicken etc.	Hong Kong	11,250	113,633
	Japan	2,605,702	4,279,519
	Germany	-	7,624
	U.S.A.	97,849	37,030
	Australia	267,537	384,280
	New Zealand	9,040	297,159
	Other	8,536,362	3,964,963
	Total	11,527,740	9,084,208

Appendix A-2

Export by air from Thailand for selected commodities to some specific destinations

Commodity	Country	Value, ฿	
		1975	1976
(A) Fruits & Vegetables	Hong Kong	50,774,675	75,683,273
	Japan	87,008	96,039
	Saudiarabia	-	3,667
	France	108,395	411,863
	Germany	-	6,452
	U.S.A.	-	204
	Other	7,847,553	14,916,488
	Total	58,816,631	91,127,986
(B) Live Fish / Animal	Hong Kong	9,109,756	12,484,184
	Japan	3,383,844	2,531,110
	Saudiarabia	1,221	-
	France	149,680	122,937
	Germany	1,661,935	1,425,517
	U.S.A.	5,377,584	5,962,534
	Australia	40,211	25,763
	New Zealand	2,035	6,683
	Other	9,821,717	10,974,052
	Total	29,547,983	33,532,780

Appendix A-2 (cont'd)

Commodity	Country	Value, Bht	
		1975	1976
(C) Flowers / Plants	Hong Kong	16,974	277,516
	Japan	5,488,875	11,099,462
	France	81,187	241,687
	Germany	50,584,789	55,261,199
	U.S.A.	14,518	60,226
	Australia	104,776	306,514
	Other	22,461,476	37,202,476
	Total	78,752,595	104,449,080
(D) Textiles & Textile Articles	Hong Kong	9,221,906	9,422,556
	Japan	9,413,361	7,622,060
	Saudiarabia	1,625,742	7,316,120
	France	3,179,813	6,979,087
	Germany	28,839,736	62,367,590
	Agentina	2,383	-
	Brazil	94,885	28,879
	U.S.A.	78,531,041	66,959,850
	Australia	12,042,156	13,217,166
	New Zealand	775,367	741,299
	Other	88,366,969	200,212,246
	Total	232,093,359	374,866,853

Appendix A-2 (cont'd)

Commodity	Country	Value, Bht	
		1975	1976
(E) Machineries & Mechanical Appliances ; Electrical Equipment , Parts there of	Hong Kong	41,105,337	185,292,825
	Japan	3,852,330	8,557,935
	Saudiarabia	-	36,733
	France	-	185,749
	Germany	2,434,137	35,438,015
	U.S.A.	28,349,314	252,404,562
	Australia	47,844	3,658,901
	Other	332,706,515	494,512,986
	Total	408,495,477	980,087,706
(F) Pharmaceuticals / Toiletries / Cosmetics	Hong Kong	226,032	1,123,012
	Japan	12,718	8,150
	Saudiarabia	-	230,207
	France	-	1,070
	Germany	11,233	5,509
	U.S.A.	38,982	6,601
	New Zealand	5,582	-
	Other	7,523,377	3,920,135
	Total	7,817,934	5,294,684

Appendix A-2 (cont'd)

Commodity	Country	Value, Bht	
		1975	1976
(G) Pearls & Precious & Semi-Precious Stones, Precious & Ralled Precious Metals & Article there of Imitation Jewelly Coin	Hong Kong	67,609,977	48,368,417
	Japan	168,908,941	178,618,460
	Saudiarabia	313,890	3,812,237
	France	5,255,465	4,243,700
	Germany	26,063,216	52,570,988
	Brazil	18,315	-
	U.S.A.	41,071,529	50,641,207
	Australia	20,484,400	18,872,007
	New Zealand	196,510	168,206
	Other	134,547,038	197,730,320
	Total	464,469,287	555,025,542
(H) Foodstuffs ; Meat , Fish and Chicken etc.	Hong Kong	8,619,640	11,271,129
	Japan	333,706	108,641
	France	38,005	537,706
	Germany	-	4,992
	U.S.A.	685,542	64,378
	Australia	855	1,748
	Other	1,434,858	768,526
	Total	11,112,606	12,757,120

Appendix B - 1

Aircraft Movements

Bangkok International Airport

Year	International				Domestic				Other			
	Total	Peak		Variation %	Total	Peak		Variation %	Total	Peak		Variation %
		Month	Total			Month	Total			Month	Total	
1968	26,836	Jan	2,802	-	4,111	Dec	417	-	34,411	Dec	6,200	-
1969	29,308	Sep	2,876	+9.10	5,120	Jan	466	+24.54	10,736	Jan	2,823	-68.80
1970	34,551	Aug	3,246	+17.89	5,817	Dec	511	+13.61	10,082	Dec	1,334	-6.09
1971	37,037	Oct	3,271	+7.20	6,082	Jan	566	+4.56	12,003	Feb	1,869	+19.05
1972	39,350	Oct	3,670	+6.25	6,309	Mar	592	+3.73	16,083	Feb	3,259	+33.99
1973	43,801	Oct	4,017	+11.31	6,395	Jan	564	+1.36	10,047	Feb	1,665	-37.53
1974	43,628	Dec	3,827	-0.39	6,089	Jan	576	-4.78	10,647	Feb	2,740	+5.97
1975	48,374	Jan	3,764	-1.02	6,152	Jan	641	+1.03	7,328	Feb	1,623	-31.17
1976	43,057	Mar	3,567	-0.29	6,769	Dec	624	+10.03	8,160	May	1,645	+11.35

(1) Variations in % compared with the previous year

Appendix B - 2

Total International Air Transport

Passengers

Year	Embarked	Peak		Disembarked	Peak		Transit	Peak		Total	Peak	
		Month	Total		Month	Total		Month	Total		Month	Total
1968	393,223	Oct	36,319	388,904	Oct	37,143	331,645	Dec	42,660	1,113,772	Dec	111,174
1969	494,155	Oct	47,903	473,757	Oct	47,803	362,573	Aug	37,189	1,330,405	Oct	132,320
1970	630,743	Aug	67,229	618,908	Aug	65,909	490,057	Aug	51,279	1,739,708	Aug	184,417
1971	622,030	Nov	59,684	614,182	Oct	60,578	574,268	Aug	61,230	1,810,480	Oct	171,637
1972	777,855	Oct	76,992	775,452	Dec	78,372	740,738	Aug	82,920	2,294,045	Oct	211,952
1973	985,469	Aug	91,439	981,126	Dec	92,869	896,262	Aug	95,598	2,862,857	Aug	273,723
1974	1,066,868	Aug	99,010	1,049,405	Dec	105,446	880,913	Aug	92,754	2,997,186	Aug	286,751
1975	1,196,226	Aug	109,601	1,174,232	Dec	116,264	934,114	Aug	103,380	3,304,572	Aug	314,750
1976	1,362,889	Jan	117,385	1,322,203	Dec	110,697	977,369	Aug	102,283	3,662,461	Aug	327,158

Appendix B - 3

Total International Air Transport

Freight (kg.)

Year	Loaded	Peak		Unloaded	Peak		Total	Peak	
		Month	Total		Month	Total		Month	Total
1968	6,651,670	Nov	657,980	6,729,110	Nov	660,250	13,380,780	Nov	1,318,230
1969	7,173,090	Oct	678,700	7,522,260	Mar	724,310	14,695,350	Oct	1,400,900
1970	10,772,360	Nov	1,083,130	9,883,210	Oct	962,590	20,155,570	Nov	2,007,100
1971	14,888,030	Aug	2,341,940	9,233,270	Sep	850,010	24,121,350	Aug	3,073,030
1972	15,761,160	Aug	1,764,330	9,729,970	Nov	1,104,110	25,491,130	Aug	2,673,500
1973	18,580,300	Sep	1,965,030	15,111,830	Dec	2,431,650	33,692,130	Mar	4,178,260
1974	27,772,450	Jul	3,741,680	17,208,500	Sep	2,212,830	44,980,950	Jul	5,222,720
1975	29,252,830	Jul	3,149,520	21,872,940	Jul	2,155,490	51,725,770	Jul	5,305,010
1976	37,180,240	Aug	4,316,280	26,340,050	Nov	4,949,020	63,520,290	Nov	7,491,130

Appendix B - 4

Total International Air Transport

Mail (Kg.)

Year	Loaded	Peak		Unloaded	Peak		Total	Peak	
		Month	Total		Month	Total		Month	Total
1968	1,049,480	Jun	147,170	843,880	Feb	155,570	1,893,360	Dec	233,070
1969	971,120	Dec	111,390	869,890	Mar	87,610	1,841,010	Dec	195,720
1970	1,446,110	Jul	203,850	1,065,200	Jun	133,220	2,511,370	Jan	313,060
1971	1,528,460	Dec	166,880	966,950	Sep	161,720	2,495,410	Sep	272,840
1972	1,690,060	Mar	191,020	1,228,400	Dec	154,300	2,918,460	Dec	311,810
1973	1,423,800	Mar	151,420	1,108,920	Nov	125,810	2,532,120	Dec	249,280
1974	1,651,680	Dec	167,780	1,686,150	Mar	199,690	3,337,830	Oct	332,990
1975	1,672,060	Jul	178,550	1,880,550	Sep	191,580	3,552,610	Jul	365,600
1976	1,749,760	Nov	170,330	1,483,970	Mar	177,100	3,233,730	Mar	341,350

Appendix B - 5

Total Domestic Air Transport

Passengers

Year	Embarked	Peak		Disembarked	Peak		Total	Peak	
		Month	Total		Month	Total		Month	Total
1968	53,831	Dec	5,725	59,840	Dec	6,097	113,671	Dec	11,822
1969	69,766	Nov	6,720	77,187	Nov	7,261	146,953	Nov	13,981
1970	80,781	Dec	7,816	88,728	Dec	8,259	169,509	Dec	16,875
1971	85,671	Apr	8,180	94,953	Apr	8,881	180,624	Apr	17,061
1972	91,580	Dec	8,683	100,345	Mar	9,328	191,925	Mar	17,816
1973	103,798	Mar	9,306	111,127	Apr	9,965	214,925	Mar	19,188
1974	96,543	Jan	9,540	105,712	Jan	10,499	202,255	Jan	20,039
1975	101,180	Jan	10,443	109,189	Jan	11,367	210,369	Jan	21,810
1976	110,347	Dec	10,806	122,458	Feb	11,716	232,805	Dec	21,954

Appendix B - 6

Total Domestic Air Transport

Freight (Kg.)

Year	Loaded	Peak		Unloaded	Peak		Total	Peak	
		Month	Total		Month	Total		Month	Total
1968	1,120,760	Mar	103,700	155,610	May	19,020	1,276,370	Mar	118,960
1969	878,440	Jan	91,970	143,430	Jan	17,190	1,021,870	Jan	109,160
1970	1,041,210	Dec	108,960	162,880	May	17,380	1,204,090	Dec	124,010
1971	936,480	Jan	101,180	182,750	Aug	18,000	1,119,230	Jan	118,030
1972	834,430	Jul	79,850	187,160	Dec	17,430	1,021,590	Jul	96,200
1973	677,830	Jan	62,790	173,720	Jan	15,800	851,550	Jan	78,590
1974	707,330	Aug	68,060	176,770	May	17,710	884,100	Aug	85,230
1975	813,840	Nov	80,170	182,960	Dec	17,930	996,800	Jan	97,090
1976	766,580	Dec	77,270	221,730	Aug	23,560	988,310	Dec	98,980

Appendix B - 7

Total Domestic Air Transport

Mail (Kg.)

Year	Loaded	Peak		Unloaded	Peak		Total	Peak	
		Month	Total		Month	Total		Month	Total
1968	52,630	Dec	6,130	28,670	Dec	2,890	81,300	Dec	9,020
1969	54,000	Dec	6,270	31,920	Nov	3,470	85,920	Dec	9,660
1970	59,330	Dec	8,880	34,860	Dec	3,740	94,190	Dec	12,620
1971	65,110	Nov	8,150	42,340	Jun	6,320	107,450	Nov	12,500
1972	63,640	Sep	7,140	49,870	Jun	9,010	113,510	Sep	11,500
1973	71,400	Dec	7,570	47,610	Aug	4,420	119,010	Dec	11,790
1974	80,890	Dec	8,660	47,800	Dec	5,020	128,690	Dec	13,680
1975	104,680	Jan	22,800	68,530	Jan	14,630	173,210	Jan	37,430
1976	92,120	Dec	10,040	78,980	Oct	9,650	171,100	Dec	18,410

Appendix B - 8

Annual Evaluation of Passengers

Year	International						Domestic			
	Embarked	Variation %	Disembarked	Variation %	Transit	Variation %	Embarked	Variation %	Disembarked	Variation %
1968	393,223	-	388,904	-	331,645	-	53,831	-	59,840	-
1969	494,155	+25.67	473,753	+21.82	362,573	+9.33	69,766	+29.60	77,187	+28.99
1970	630,743	+27,64	618,908	+30.64	490,057	+35.16	80,781	+15.79	88,728	+14.95
1971	622,03e	-1.38	614,182	-0.76	574,268	+17.18	85,671	+6.05	94,953	+7.02
1972	777,855	+25.05	775,452	+26.26	740,738	+28.98	91,580	+6.90	100,345	+5.08
1973	985,469	+26.69	981,126	+26.52	896,262	+20.99	103,798	+13.34	111,127	+10.74
1974	1,066,868	+8.26	1,049,405	+6.96	880,913	-1.71	96,543	-6.99	105,712	-4.87
1975	1,196,226	+12.13	1,174,232	+11.90	934,114	+6.04	101,180	+4.80	109,189	+3.29
1976	1,362,889	+13.93	1,322,203	+12.60	977,369	+4.63	110,347	+9.06	122,458	+12.15

Appendix B - 9

Annual Evaluation of Freight

Year	International				Domestic			
	Loaded(Kg.)	Variation %	Unloaded(Kg.)	Variation %	Loaded(Kg.)	Variation %	Unloaded(Kg.)	Variation %
1968	6,651,670	-	6,729,110	-	1,120,760	-	155,610	-
1969	7,173,090	+7.83	7,522,260	+11.79	878,440	-21.62	143,430	-7.83
1970	10,772,360	+50.18	9,383,210	+24.74	1,041,210	+18.53	162,880	+13.56
1971	14,888,080	+38.21	9,233,270	-1.60	936,480	-10.06	182,750	+12.20
1972	15,761,160	+5.86	9,729,970	+5.38	834,430	-10.90	187,160	+2.41
1973	18,580,300	+17.89	15,111,830	+55.31	677,830	-18.77	173,720	-7.18
1974	27,772,450	+49.47	17,208,500	+13.87	707,330	+4.35	176,770	+1.76
1975	29,852,830	+7.49	21,872,940	+27.11	813,340	+15.06	182,960	+3.50
1976	37,180,240	+24.55	26,340,050	+20.42	766,580	-5.81	221,730	+21.19

Appendix B - 10

Annual Evaluation of Mail

Year	International				Domestic			
	Loaded (Kg.)	Variation %	Unloaded (Kg.)	Variation %	Loaded (Kg.)	Variation %	Unloaded (Kg.)	Variation %
1968	1,049,480	-	843,880	-	52,630	-	28,670	-
1969	971,120	-7.47	869,890	+3.08	54,000	+2.60	31,920	+11.34
1970	1,446,110	+48.91	1,065,260	+22.46	59,330	+9.87	34,860	+9.21
1971	1,528,460	+5.70	966,950	-9.23	65,110	+9.74	42,340	+21.46
1972	1,690,060	+10.57	1,228,400	+27.04	63,640	-2.26	49,870	+17.78
1973	1,423,200	-15.79	1,108,920	-9.73	71,400	+12.19	47,610	-4.53
1974	1,651,680	+16.05	1,686,150	+52.05	80,890	+13.29	47,800	+0.40
1975	1,672,060	+1.24	1,880,550	+11.52	104,680	+29.41	68,530	+30.25
1976	1,749,760	+4.65	1,483,970	-21.09	92,120	-12.00	78,980	+15.25

Appendix B - 11

All - Freight/Mail Services

At Bangkok International Airport

Year 1974

Month	Aircraft Movement Total	Freight (Kg.)			Mail (Kg.)		
		Loaded	Unloaded	Total	Loaded	Unloaded	Total
Jan	115	148,860	70,950	219,810	170	-	170
Feb	123	145,880	104,850	250,730	510	210	720
Mar	133	177,250	146,250	323,500	-	-	-
Apr	110	130,050	119,790	249,840	90	-	90
May	100	121,900	146,150	268,050	-	80	80
Jun	110	271,760	186,460	458,220	210	-	210
Jul	130	190,240	121,150	311,390	1,190	210	1,400
Aug	113	153,320	89,680	243,000	100	-	100
Sep	122	112,020	146,840	258,860	220	200	420
Oct	122	104,500	66,680	171,180	730	670	1,400
Nov	120	151,850	115,970	267,820	-	810	810
Dec	118	184,040	110,190	294,230	1,650	-	1,650
Total	1,416	1,891,670	1,424,960	3,316,630	4,870	2,180	7,050

Appendix B - 12

All - Freight/Mail Services

At Bangkok International Airport

Year 1975

Month	Aircraft Movement Total	Freight (Kg.)			Mail (Kg.)		
		Loaded	Unloaded	Total	Loaded	Unloaded	Total
Jan	111	134,320	83,440	217,760	60	-	60
Feb	93	106,330	98,540	204,870	70	-	70
Mar	149	297,720	107,150	404,870	3,000	-	3,000
Apr	186	378,510	378,860	757,370	710	-	710
May	139	216,220	158,570	374,790	990	-	990
Jun	129	283,210	300,330	583,540	11,210	3,610	14,820
Jul	88	252,150	182,570	434,720	40	130	170
Aug	104	259,560	125,620	385,180	980	20	1,000
Sep	108	262,690	49,200	311,890	1,430	-	1,430
Oct	117	251,470	85,850	337,320	580	-	580
Nov	112	252,150	127,530	379,680	810	-	810
Dec	108	156,100	130,480	286,580	710	-	710
Total	1,444	2,850,430	1,828,140	4,678,570	20,590	3,760	24,350

Appendix B - 13

All - Freight/Mail Services

At Bangkok International Airport

Year 1976

Month	Aircraft Movement Total	Freight (Kg.)			Mail (Kg.)		
		Loaded	Unloaded	Total	Loaded	Unloaded	Total
Jan	76	138,370	78,900	217,270	700	-	700
Feb	83	166,140	90,320	256,460	1,980	500	2,480
Mar	101	208,130	359,410	567,540	1,440	-	1,440
Apr	106	144,390	16,640	161,030	570	-	570
May	122	192,840	59,260	252,100	2,620	80	2,700
Jun	121	174,750	62,020	236,770	1,070	-	1,070
Jul	119	361,400	166,190	527,590	1,260	-	1,260
Aug	124	425,600	171,580	597,240	-	-	-
Sep	136	315,400	215,500	530,900	130	100	230
Oct	135	253,030	212,100	465,130	840	-	840
Nov	155	230,540	263,730	494,270	4,250	-	4,250
Dec	131	211,040	210,120	421,160	3,450	240	3,690
Total	1,409	2,821,680	1,905,770	4,727,460	18,310	920	19,230

Appendix C-1

Scheduled Flights

Bangkok International Airport (1977)

No.	Airline	Callsign	Flight	Aircraft
1	Aeroflot	Aeroflot	SU	IL-62
2	Air India	AI	AI	B-707
3	Air France	AF	AF	B-707,B-747
4	Alitalia	AZ	AZ	DC-10,DC-8
5	Air Ceylon Ltd.	-	AE	DC-8,Trident
6	Royal Brunei Airlines	-	BI	B-737
7	Alia The Royal Jordanian Airline	Alia	RJ	B-747
8	Bangladesh Biman	-	BG	B-707
9	British Airways Overseas Division	BOAD	BA	B-707,B-747
10	Cathay Pacific Airway Ltd.	CPA	CX	B-707
11	Chaina Airlines	CAL	CI	B-727,B-707
12	Deutsche Lufthansa	DLH	LH	DC-10,B-707 B-747
13	Egypt Air	-	MS	B-707
14	Garuda Indonesian Airways	GIA	GA	DC-10,DC-8
15	Iraqi Airways	Iraqi	IA	B-747
16	Japan Airlines Company Ltd.	JAL	JL	DC-10,B-747 DC-8
17	Korean Airlines Inc.	KAL	KE	B-707,DC-10
18	KLM Royal Dutch Airlines	KLM	KL	DC-10,DC-8 B-747
19	Malaysian Airline System	MAS	MH	B-737
20	Pakistan International Airlines Corp.	PIA	PK	DC-10,B-707

Appendix C-1 (cont'd)

No.	Airline	Callsign	Flight	Aircraft
21	Pan American World Airways Inc.	PAA	PA	B-747
22	Philippine Airlines Inc.	PAL	PR	DC-8,DC-10
23	Quantas Airways Limited	QEA	QF	B-707,B-747
24	Laos Aviation	-	LS	AN-24
25	Royal Nepal Airlines Corp.	RNAC	RA	B-727
26	Sabena	Sabena	SN	DC-10,B-707
27	Scandinavian Airlines System	SAS	SK	DC-10,DC-8
28	Singapore Airlines Limited	SIA	SQ	B-707,B-737 B-747
29	Swiss Air	SWR	SR	DC-8,DC-10
30	Thai Airways Co.,Ltd.	TAC	TH	Avro-748
31	Thai Airways International Ltd.	Thai	TG	DC-8,DC-10
32	Trans Mediteranean Airlines	TMA	TL	B-707
33	Union De Transports Airlines	UTA	UT	DC-8,DC-10
34	Burma Airways Corporation	UBA	UB	F-28,F-27
35	Finn Air	-	RY	DC-8
36	Lot-Polish Airlines	Lot	LO	IL-62

Appendix C-2

Non Scheduled Flights

Bangkok International Airport (1977)

No.	Airline	Callsign	Flight
1	Balair	-	BB
2	Condor	-	DF
3	Cargolux	-	CV
4	British Caledonian	-	BR
5	Luxair	-	LX
6	Martin's Air Charter	-	MP
7	Philippine Aero Transport	-	PN
8	Seaboard World Airways	-	SB
9	Trans Meridian Aircargo	TMAC	KK
10	Tradewinds	-	IK
11	Trans International Airways	TIA	TV
12	German Cargo	-	GE
13	Philippine Sterling Airlines	-	-
14	World Airways	-	-

Appendix D-1

Simple Linear Regression

I. The Normal Equations for Simple Regression

In simple regression there are two variables : the variable to be forecasted (y) called the dependent variable and the variable on which the forecast is based (x) called the independent variable . The terms dependent and independent indicate that the variable " y " depends on the variable " x " but that variable " x " is independent of variable " y " . Simple linear regression can be used with both time series data and crossectional data as long as there is only one independent variable.

The forecasting equation for simple linear regression is :

$$y' = a + bx$$

It is unlikely that this equation will exactly fit the sample data , certain errors or deviations will appear . These errors can be represented by the variable " u " , which assumes the values u_1 , u_2 , u_3 ..... u_n where " n " is the number of observations in the sample .

The equation above can now be rewritten in terms of the actual values of " y " given in the sample (y) rather than in terms of the forecast values (y') :

$$y = a + bx + u$$

with the condition that the average (mean) value of " u " is zero , and where

$$y_1 - y'_1 = u_1 = y_1 - a - bx_1$$
$$y_2 - y'_2 = u_2 = y_2 - a - bx_2$$
$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$
$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$
$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$
$$y_n - y'_n = u_n = y_n - a - bx_n$$

That is , " u " is a measure of the deviations of the predicted values (y') from the values observed in the sample (y) .

The problem now is to find the values of " a " and " b " which will minimize the sum of the squared deviations defined by the variable " u " .

Let the variable " D " represent the sum of the squared deviations , that is :

$$D = u_1^2 + u_2^2 + u_3^2 + \cdots\cdots + u_n^2$$
$$= (y_1 - a - bx_1)^2 + (y_2 - a - bx_2)^2 + \cdots\cdots$$
$$+ (y_n - a - bx_n)^2$$

It can be demonstrated that " D " is minimized if " a " and " b " are calculated as :

$$a = \frac{\Sigma x^2 . \Sigma y - \Sigma x . \Sigma xy}{n . \Sigma x^2 - (\Sigma x)^2}$$

$$b = \frac{n . \Sigma xy - \Sigma x \Sigma y}{n . \Sigma x^2 - (\Sigma x)^2}$$

As stated in the text the same least squares method described in the previous page can be used to determine the coefficients for an exponential trend curve if the dependent variable is first converted to logarithms . Techniques can be applied which make it possible to determine the shape of a modified exponential , a logistics or a Gompertz curve which fits the data .

II. The Coefficient of Determination

For an understanding of the coefficient of determination the following relationship is useful :

$$(y - \bar{y}) = (y - y') + (y' - \bar{y})$$

where " y " is the sample value , " $\bar{y}$ " is the average value of the dependent variables in the sample , and " y' " is the value of the dependent variable predicted by the least squares line .

The ($y - \bar{y}$) shows the total error (total deviation) because it is the error between the actual sample value of " y " and the arithmatic mean " $\bar{y}$ " which is the estimator of " y " when no regression line is used .

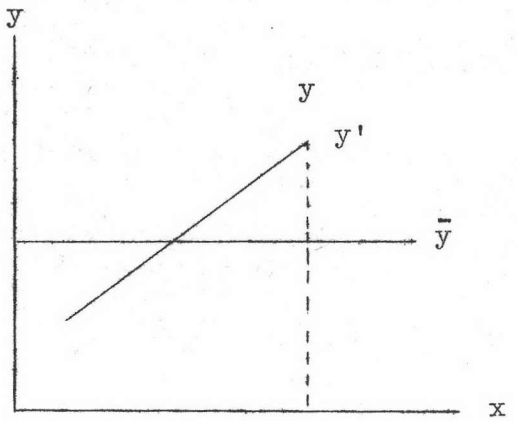
The ($y' - \bar{y}$) is called the explained error because it represents the amount of error removed when the regression line is fitted to the points .

Finally , the ($y - y'$) is the unexplained error because it is the error that still remains after the regression line has been fitted .

Thus each point can be decomposed into :

total error = unexplained error + explained error

The graph below shows each one of these error components .



Therefore

$$(y - \bar{y}) = (y - y') + (y' - \bar{y})$$

for each of the sample observations , or

$$\Sigma (y - \bar{y}) = \Sigma (y - y') + \Sigma (y' - \bar{y})$$

for the entire sample . Squaring each expression to eliminate the negative signs gives :

$$\Sigma (y - \bar{y})^2 = \Sigma (y - y')^2 + \Sigma (y' - \bar{y})^2$$

The expression $\Sigma (y - \bar{y})^2$ is called the total sum of squares and the equation above shows it can be partitioned into the $\Sigma (y - y')^2$ which is called the unexplained sum of squares , and the $\Sigma (y' - \bar{y})^2$ which is called the explained sum of squares .

Since the relationship of concern here is that between the explained sum of squares and the total sum of squares , both sides of the previous equation can be divided through by $\Sigma (y - \bar{y})^2$ giving :

$$1 = \frac{\Sigma (y - y')^2}{\Sigma (y - \bar{y})^2} + \frac{\Sigma (y' - \bar{y})^2}{\Sigma (y - \bar{y})^2}$$

The sample coefficient of determination (r^2) is defined as

$$r^2 = \frac{\Sigma (y' - \bar{y})^2}{\Sigma (y - \bar{y})^2}$$

$$= \frac{\text{explained sum of squares}}{\text{total sum of squares}}$$

The square root of this expression (that is " r ") is called the sample correlation coefficient and has the same sign as that of the regression coefficient " b " .

The r^2 shows the relative reduction in the total sum of squares (total error) when a regression line is fitted . For example , when $r^2 = 0.07$, it means that there has been a 70% reduction in the total sum of squares (total error) by fitting the regression line . Thus , r^2 shows the amount of improvement brought by fitting the regression line .

For purpose of calculating the sample correlation coefficient , it is easier to use :

$$r = \frac{n \Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[n \Sigma x^2 - (\Sigma x)^2][n \Sigma y^2 - (\Sigma y)^2]}}$$

The sample coefficient of determination (r^2) is obtained by simply squaring the previous result .

Appendix D-2

A Method for determining the Coefficients for a Modified Exponential Curve and a Gompertz Curve

The procedure for using the modified exponential curve is initially to calculate the first differences of the dependent variable from the sample data and then find the ratios of these first differences to see if they show a tendency to be constant . If , in addition , the freehand curve drawn to approximate the sample data tends to approach an upper or lower limit , it is desirable to try to fit a modified exponential curve .

It will be recalled from the text that the equation for a modified exponential trend is $y = k + ab^x$ and that the ratio of the first differences for this equation are given by :

$$\frac{y_3 - y_2}{y_2 - y_1} \quad , \quad \frac{y_4 - y_3}{y_3 - y_2}$$

etc. and are equal to " b " .

To find the values for " k " , " a " and " b " the method of selected points cam be used . From the freehand curve fitted to the scatter diagram , three points should be selected (P_1 , P_2 and P_3). If the number of years between P_1 , P_2 , and P_3 are " t " years , respectively , the formulas for the coefficients are :

$$b^t = \frac{P_3 - P_2}{P_2 - P_1}$$

$$a = \frac{P_2 - P_1}{b^t - 1} \quad , \quad k = P_1 - a$$

Appendix D-3

Multiple Regression

I. The Normal Equations for Multiple Regression

In simple linear regression there is one dependent variable and one independent variable . The linear function has two determining constants , " a " and " b " , because only two points are required to completely determine a straight line . However , it is easy to see that in many situations there is more than one factor (independent variable) that affects a certain outcome (dependent variable) . All of the econometric models presented in the text use more than one independent variable and the following description illustrates how to fit the models with more than one independent variable .

The statistical technique of extending simple linear regression so that it considers more than one independent variable is called multiple linear regression . The equation will take the form :

$$(1) \quad y' = a + b_1x_1 + b_2x_2 + b_3x_2 + \ldots\ldots + b_nx_n$$

for " n " independent variables .

If it is assumed , for simplicity , that there are two independent variables , the estimating equation can take the form of :

$$(2) \quad y' = a + b_1x_1 + b_2x_2$$

$$(3) \quad y = a + b_1x_1 + b_2x_2 + u$$

where " y " is the predicted value of the dependent variable , " y " is its sample value and " u " is the error term , the problem then is

to find the values of " a " , " b_1" and " b_2" which minimize the sum of squares around a three-dimensional plane .

The normal equations obtained from equation(2) and (3) are :

$$(4) \quad na + b_1 \Sigma x_1 + b_2 \Sigma x_2 = \Sigma y$$

$$(5) \quad a \Sigma x_1 + b_1 \Sigma x_1^2 + b_2 \Sigma x_1 x_2 = \Sigma x_1 y$$

$$(6) \quad a \Sigma x_2 + b_1 \Sigma x_1 x_2 + b_2 \Sigma x_2^2 = \Sigma x_2 y$$

Since there are three equations and three unknowns (a , b_1 and b_2) , these equations can be solved simultaneously for the values of the unknowns .

Generalizing the above procedure for " m " independent variables , a , b_1 , b_2 , ... , b_m , the normal equations are :

$$na + b_1 \Sigma x_1 + b_2 \Sigma x_2 + \cdots\cdots + b_m \Sigma x_m = \Sigma y$$

$$a \Sigma x_1 + b_1 \Sigma x_1^2 + b_2 \Sigma x_1 x_2 + \cdots\cdots + b_n \Sigma x_1 x_m = \Sigma x_1 y$$

$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$

$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$

$$a \Sigma x_m + b_1 \Sigma x_m x_1 + b_2 \Sigma x_m x_2 + \cdots\cdots + b_m \Sigma x_n^2 = \Sigma x_m y$$

Various procedures have been devised to simplify the calculation of the coefficients of a multiple regression equation . Those who do not have access to a computer should find the following simplification of the computational procedures a big help .

Since the sum of the deviations around the mean is zero :

$$\Sigma (x - \bar{x}) = \Sigma x - n\bar{x} = \Sigma x - \Sigma x = 0$$

the normal equations of (4) , (5) and (6) can be simplified by shifting the origin of each of the three normal equations to $\bar{y}$, $\bar{x}_1$ and $\bar{x}_2$ respectively . Then the term Σx_1 , Σx_2 and Σy become zero , because $\Sigma (x_1 - \bar{x}_1) = 0$, $\Sigma (x_2 - \bar{x}_2) = 0$, and $\Sigma (y - \bar{y}) = 0$.

If the following relationships are made :

$$X_1 = x_1 - \bar{x}_1 , X_2 = x_2 - \bar{x}_2 \text{ and } Y = y - \bar{y}$$

the normal equations for equation (4) , (5) and (6) become

$$(7) \quad b_1 \Sigma X_1^2 + b_2 \Sigma X_1 X_2 = \Sigma X_1 Y$$
$$(8) \quad b_1 \Sigma X_1 X_2 + b_2 \Sigma X_2^2 = \Sigma X_2 Y$$

The above shows the general theoritical considerations which are involved in multiple linear regression . To calculate ΣX_1^2 , $\Sigma X_1 X_2$ etc. in the normal equations (7) and (8) above , the computational formulas

$$\Sigma X_1^2 = \Sigma (x_1 - \bar{x}_1)^2 = \Sigma x_1^2 - n(\bar{x}_1)^2$$

and

$$\Sigma X_1 X_2 = \Sigma (x_1 - \bar{x}_1)(x_2 - \bar{x}_2) = \Sigma x_1 x_2 - n(\bar{x}_1)(\bar{x}_2)$$

will be used .

II. The Coefficient of Multiple Determination

After having found the regression equation one would like to known the closeness of fit of the regression plane to the actual sample

observations . The coefficient of multiple determination is used to indicate the closeness of fit of the regression plane .

This coefficient makes use of the same fundamental identity as that used for the coefficient of determination in the simple linear regression case described in Appendix D-1 namely ,

$$\Sigma (y - \bar{y})^2 = \Sigma (y - y')^2 + \Sigma (y' - \bar{y})^2$$

or ,

Total variation = Unexplained variation + Explained variation

The coefficient of multiple determination (R^2) is simply the ratio of the explained variation to the total variation

$$R^2 = \frac{\Sigma (y' - \bar{y})^2}{\Sigma (y - \bar{y})^2}$$

For case of computation , the short cut method explained in Section I can be used .

$$R^2 = \frac{b_1 \Sigma X_1 Y + b_2 \Sigma X_2 Y}{\Sigma Y^2}$$

The square root of R^2 is called the coefficient of multiple correlation (**R**) , a term that was used frequently in the past but less used today .

III. The Partial Correlation Coefficients

The partial correlation coefficient shows the relationship between two variables holding all other variables constant . In order to make the notation simple , for the example used in Section I , let $y = X_1$, $x_1 = X_2$ and $x_2 = X_3$ so that the notations can be written as subscripts of X . For example , it might be of interest to know the correlation between y and x_1 , leaving x_2 constant (written in new notation as $r_{x_1 x_2 \cdot x_3}$ or simply $r_{12.3}$) . Alternatively , the correlation between y and x_2 keeping x_1 constant ($r_{13.2}$) can be found as well as the correlation of x_1 and x_2 keeping y constant($r_{23.1}$). This section will illustrate the calculation of $r_{12.3}$ but the procedure can easily be generalized to any partial correlation

$$r_{12.3} = \frac{r_{12} - r_{13} \cdot r_{23}}{\sqrt{(1 - r_{13}^2)(1 - r_{23}^2)}}$$

where in general terms

$$r_{ij} = \frac{\Sigma x_i y_j}{\sqrt{(\Sigma x_i^2)(\Sigma x_j^2)}}$$

is the total correlation coefficient between x_i and x_j .

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