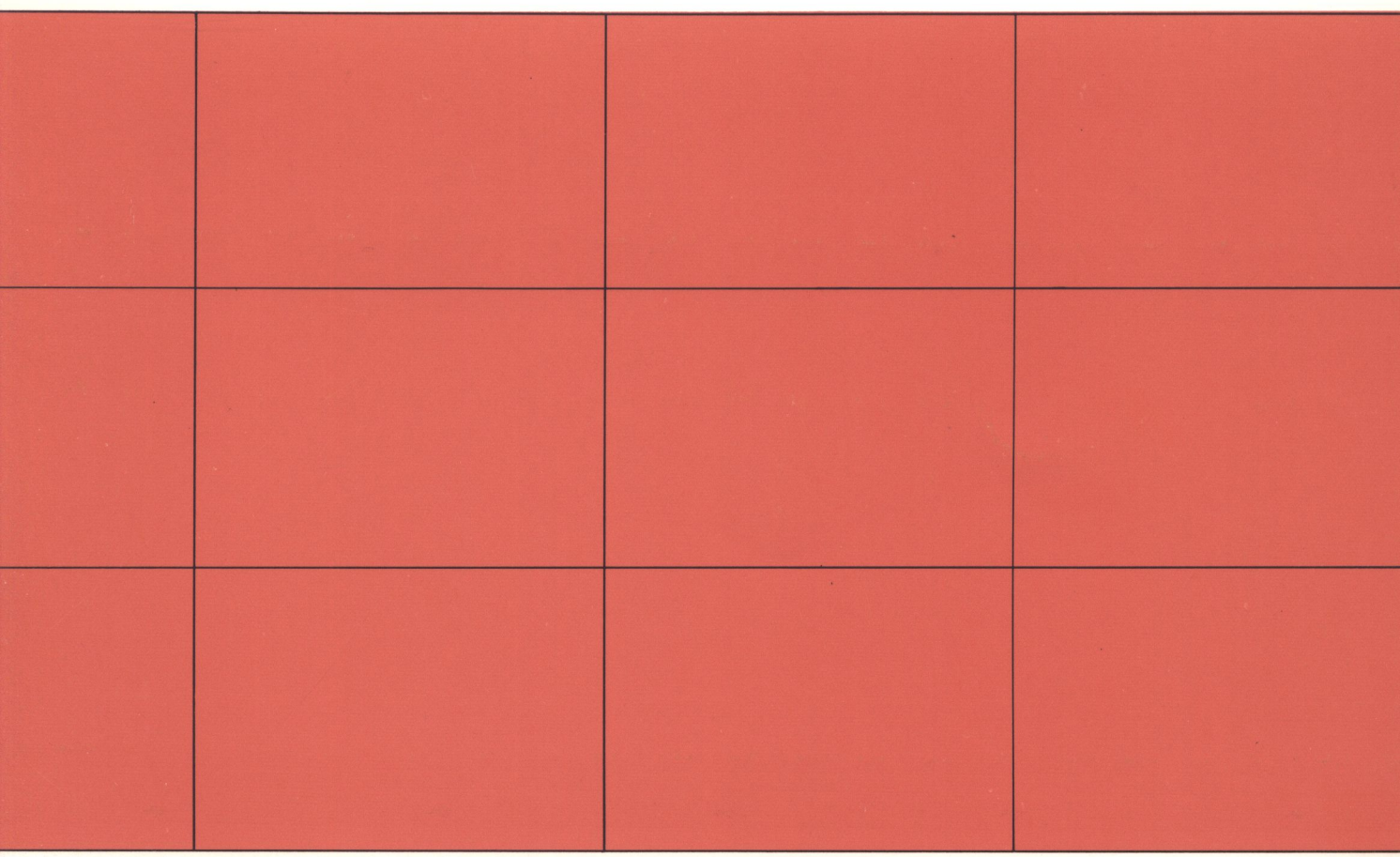
Demand Forecast for Flat Glass in Thailand



Thailand Development Research Institute Foundation

DEMAND FORECAST FOR FLAT GLASS IN THAILAND

By

Dr. Kitti Limskul

March 1990

EXECUTIVE SUMMARY

DEMAND FORECAST FOR FLAT GLASS IN THAILAND

1. Objective of the Study

The objective of this study is to explore the demand for glass products directly and indirectly related to the glass subsector. The study has three components:

1. Review of the construction series of GDP.

2. Projection of the growth of the glass sector within the construction, automotive, glassed furniture and other end-users to indicate the demand for float and plate glass for the years 1990 through 1995.

3. Determination of a date for commentcement of construction of new float glass facilities after demand forecast has been done.

SUMMARY OF CHAPTER I:

Growth of GDP Series of the Construction Sector

(1) The Thai economy is fundamentally taken-off for the sustainable growth epoch. Although she may face some cyclical downswings up to the end of 1990, the Thai economy is likely to grow with firm basis into the year 2000.

As a matter of fact, Thai economy passed the period of rapid economic expansion during the end of 1985 - the end of 1989. The economic growth rate in terms of the gross domestic products was around 12 percent in 1989. It is forecasted that the Thai economy will be slowed down in a short period up to the middle of 1990, or as latest as the first quarter of 1991. Afterwards, the economy is recovery and verging for new level of economic growth again.

(2) The favorable growth trend in the export and manufacturing sector give rise to the excess demand for asset and housing and office building in the construction sector. In addition, the durable goods like automotive is becoming one of the fast growing sectors in Thailand too.

(3) The economic activities in the construction sector is basically lagging behind the current economic condition by 2-3 quarters. Thus, the growth in the construction sector follows the ups and downs of the current economy but with different level. The growth of economic activities of the sector during 1988-1989 is estimated to be as high as 26.8 percent per year.

At present the share of construction activities as measured by the GDP or value added is 4.33 percent of total GDP at the 1972 constant prices. It has a very high growth potential as judged by our forecast.

(5) The glass sector shows a 13.45 percentage growth during 1987-1988. We expect a higher growth rate of around 17.0 percent in the sector in 1989 as a result of persistent construction boom. Owing to the small share of the sector, we therefore think that the sector has tremendously bright future too.

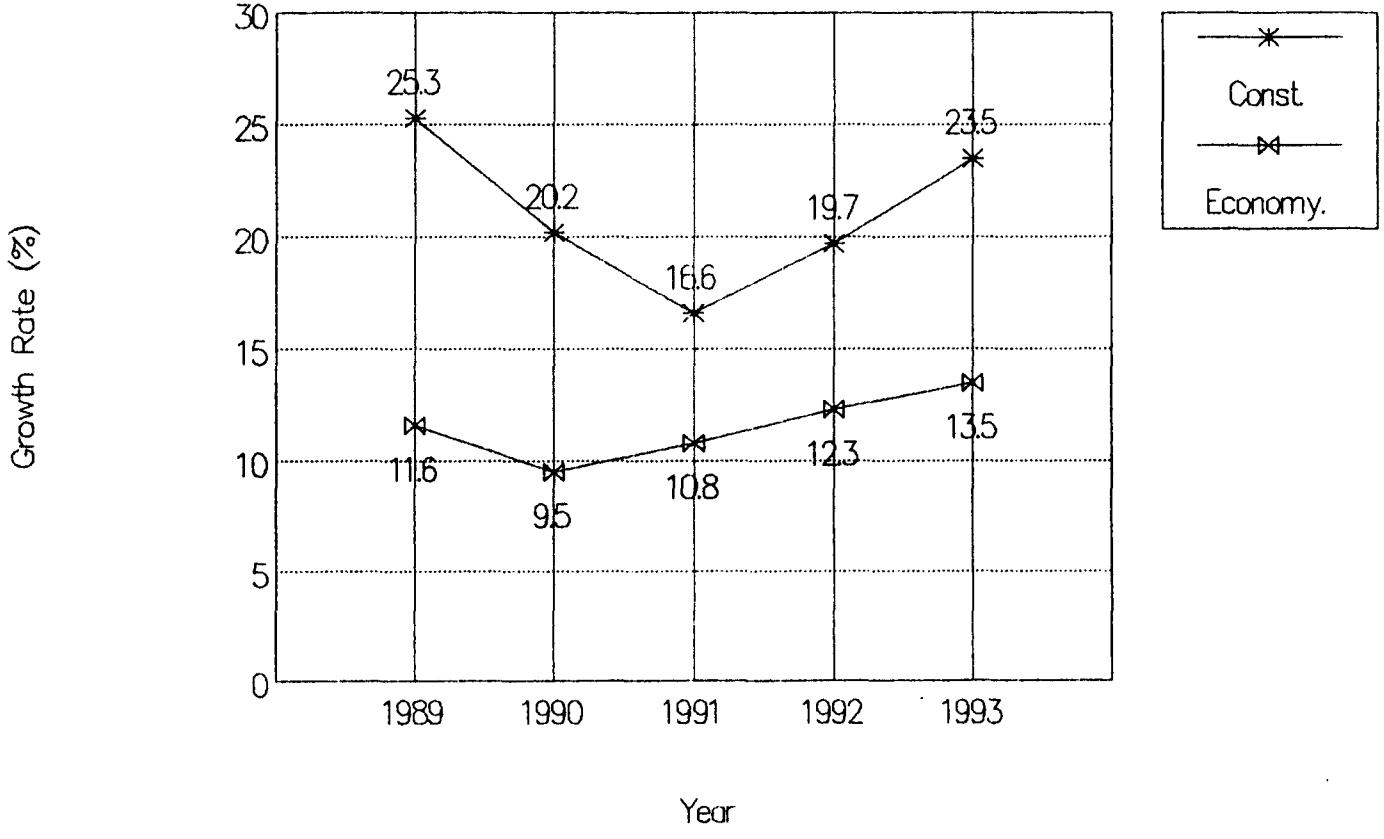
(6) The medium-term growth scenario for the GDP series of the construction sector is forecasted as follows.

Table 1: GDP Series Forecast for the Construction Sector
(in percentage per year)

	1989	1990	1991	1992	1993
Agricuture	4.6	3.0	3.5	4.1	4.2
Manufacturing	26.8	23.4	24.6	25.4	26.7
Construction	25.3	20.2	16.6	19.7	23.5
Non-Tradable	10.3	8.6	9.4	10.5	11.2
Economy-wide	11.6	9.5	10.8	12.3	13.5

Source: Annual base CGE model of EPMF programme.

GDP Series Forecast for the Construction Sector



(7) The forecast for 1994 and 1995 are expected to be not less than 17 percentage point despite possibility of facing short cyclical downswings.

SUMMARY OF CHAPTER II:

BALANCE OF SUPPLY -DEMAND FOR FLAT GLASS: 1990-1995

Demand by four main end-users are forecasted based on a very realistic demand figures. The end-users are as follows.

1) Architectural Related Activities
2) Automotive Assembly Related Activities
3) Glassed Furniture Activities
4) Others Activities that used Flat Glass

The demand-supply balance is determined by two main factors. The derived growth potential in the Thai economy that induces growth in the end-users demand. Second, the BOI's export ratio is also seen as policy instrument to direct the balance of domestic demand and supply. The existence of excess demand in the domestic market at present and in the comming future is clearly justify the allowance of any new entry or supplier into the business such that no adverse effect will be created by severe supply shortages.

Two assumptions regarding growth scenario of the consturction, automotive and other glass end-users are shown in Table 2 below.

Table 2 : End-Users' Demand Growth Scenarios
(in percentage per year)

	1990	1991	1992	1993	1994	1995
Architectural						
Medium Growth	20.2	16.6	19.7	23.5	17.0	17.0
Low Growth	17.5	13.4	11.4	10.0	10.0	10.0
Automotive						
Medium Growth	20.0	15.0	12.0	13.0	17.0	17.0
Low Growth	12.5	11.4	11.4	11.4	11.4	11.4
Glassed Furniture						
Medium&Low	10.0	9.4	9.2	10.0	10.0	10.0
Others						
Medium&Low	11.2	9.8	9.2	9.0	9.0	9.0

Source: Computed from the GDP series as of the Annual base CGE model of EPMF programme.

The medium and low demand growth scenarios provide the following results.

MEDIUM GROWTH SCENARIO

(1) Total domestic demand for flat glass by end-users are 172,282 mt., 198,016 mt., 232,110 mt., 282,293 mt., 328,649 mt. and 382,887 mt. accordingly during 1990-1995 annually.

LOW GROWTH SCENARIO

(2) Total domestic demand for flat glass by end-users are 165,076 mt., 185,963 mt., 206,532 mt., 229,574 mt., 254,105 mt. and 281,354 mt. respectively, during 1990-1995 annually.

DIFFERENCE OF DEMAND BETWEEN MEDIUM-LOW GROWTH SCENARIO

(3) Difference of Total domestic demand for flat glass by end-users between medium and low demand growth scenarios are 7,206 mt., 25,578 mt. and 101,533 mt. in 1990, 1992 and 1995 accordingly.

DOMESTIC PRODUCTION

(4) It is assumed that the Thai-Asahi produces with capacity utilization of 100% during 1990-1995 for plate production. It is also 100% for float production during the same period except the year 1992 where she reaches a cycle of maintenance. The Siam Plate produces with capacity utilization of 33.67%, 67.34% in 1989 and 1990. It is 84.18% afterwards up to 1995. In addition, the BKK-Float produces with capacity utilization of 80%, 84%, 92%, and 100% during 1992-1995 annually.

(5) The domestic production or domestic supply of flat glass are 171,900 mt., 176,900 mt., 216,200 mt., 287,900 mt. 297,900 mt. and 308,300 mt. respectively during 1990-1995 annually.

The total supply of float glass are 131,400 mt. for 1990 and 1991. They are 170,700 mt., 242,400 mt., 252,400 mt.,

and 262,800 mt. in 1992-1995. The supply of plate glass are 40,500 mt. in 1990 and 45,500 mt. in 1991-1995.

The Thai-Asahi supply of float glass are 131,400 mt. in 1990-1991. They are 65,700 mt. in 1992 and 131,400 mt. during 1993-1995. In 1992, additional supply of float glass from the BKK-float is 105,000 mt. They are 111,000 mt. in 1993 and 121,000 mt. and 131,400 mt. in 1994 and 1995.

From these supply-demand growth scenarios we construct a balance sheet of demand and supply 1990-1995. In each medium and low growth scenarios we make experiments (hereafter called Cases) whether or not there will be excess demand or supply. In the medium growth scenarios all cases signify an existence of excess demand in the industry. We have tried also with the low growth scenarios the findings are summarized as follows.

(1) In case BKK-Float has to compile with BOI condition of 80% export ratios, even under the scenario of low growth of demand it is found that excess demand exists from 1992 to 1995. (Ref. Case 1.1). They are 121,017 mt., 96,869 mt., 119,400 mt. and 144,569 mt. respectively during 1992-1995 annually.

We have tried to experiment with counterfactural assumptions that if the BKK-Float is allowed to supply her (i) 100% of production to domestic market i.e., no export (Ref. Case 1.2); (ii) export ratio for BKK-Float is 30% (Ref. Case 1.3); (iii) export ratio of BKK-Float is 50% (Ref. Case 1.4), while the

Thai-Asahi and the Siam Plate behave normally. It is found that excess demand still exists during 1992-1995.

WITH ADDITIONAL SUPPLIER

(2) We assume that additional supplier is allowed to enter into the business and test the viability of the industry. We find that there are actually certain big margin of excess demand even in this low growth scenarios. In the case of letting the additional supplier to compile with BOI condition i.e., 80% export ratio we find that the excess demand are 100,017 mt., 74,669 mt., 95,200 mt. and 118,289 mt respectively.

We make another counterfactural assumption that if the BKK-float and the new supplier are allowed to supply 50% of their production for the domestic market i.e., 50% export ratio. We find that there are as well a severe picture of excess demand for flat glàss in Thailand. They are 37,017 mt. and 39,449 mt. in 1992 and 1995 respectively.

(3) The enter of BKK-Float in the year 1995 seems to solve part of the severe problem of excess demand. It is certain that given the demand forecast 1990-1995, since no additional production capacity can be increased the problem of excess demand still exists 1990-1995 even in the case of low growth scenario. This is because every suppliers are already utilizing a near full capacity as shown in our experiment. Nevertheless, the total problem of excess demand can not be totally solved without doing something. This is either allowing another supplier to enter the

business or the country keep on loosing her foreign exchange in terms high valued of import bill of float glass. It is already known that the price of import is 2-3 times as high as the price of export. This clearly a consequence of monopolistic price strategy.

SUMMARY OF CHAPTER III: DETERMINATION OF DATE FOR COMMENCEMENT OF NEW FLOAT GLASS FACILITIES

1.ECONOMIC RATIONALE

(1) Existence of excess demand situation, proved in Chapter II, implies the inefficiency of the industy. This is mainly owing to the allowance of monopoly to exist up to considerable degree.

(2) The existence of monopoly may give rise to high supply price of flat glass and/or less quantity supplied in a normal market situation of namely short to medium term. In the longer-run, there will be tendency of insufficient supply since other new entry(entries) will be blocked. Especially, when demand is being driven to be so high like it is happening now, severe shortage is a clear consequence.

(3) From social optimal point of view, the allowance of new entry(entries) will balance the demand and supply through optimal price schedule setting. Tendency of inflationary pressure that may be spilled over from the booming construction sector will be remedied.

2. RECOMMENDED DATE OF COMMENCEMENT

(1) In our study, it is proved that additional supplier should be allowed to enter in order to help solve the severe problem of supply shortages. The starting date of supply should not be later than 1992, if government do not want unfavorable consequence of severe excess demand to occur. As time lag of factory construction, machine and furnace installation in this industry take about 20-24 months, it is strongly recommended that should the new supplier starts to supply her output in 1992, the permission of allowing new entry should be seriously considered now. In our study, one additional supplier may be an optimal solution to help the existing firms to solve severe problem of excess demand up to at least 1995.

(2) Entry of one additional supplier is being proved in our study that the industy will be more efficient and will not at all destroy the business incentives of the existing firms. Rather, allowing certain degree of competition will surely bring about impetus of new creations and favorable phenomena. Supply price will surely be lowered, more supply of output, more efficient technique will be introduced. In other words, product technology will be advanced and leading to the new era of flat glass industry in Thailand. It is expected that if one additional supplier is being allowed for, the industry as a whole will be benefit in the medium to long-run. It is quite certain that the

industry will be verging towards a very brilliant future up to not later than the year 2000 where correspondinly, Thailand should be generally accepted to join a club of the Newly Industrialized Economies.

Flat Glass Industry Demand-Supply Balance. 1987-1995

Summary Case#1 : No Additional Supplier
(Low Growth Scenario)

(Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	107,556	126,379	143,313	159,651	175,616	193,178	212,495
- Automotive	8,872	9,982	11,231	12,636	14,081	15,692	17,487	19,488	21,717
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	142,362	165,076	185,963	206,532	229,574	254,105	281,354
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) BKK Float glass	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export (Case#1.1) **	48,085	53,462	61,895	64,895	66,395	130,685	155,195	163,195	171,515
(C) : Export (Case#1.2) **	48,085	53,462	61,895	64,895	66,395	46,685	66,395	66,395	66,395
(C) : Export (Case#1.3) **	48,085	53,462	61,895	64,895	66,395	78,185	99,695	102,695	105,815
(C) : Export (Case#1.4) **	48,085	53,462	61,895	64,895	66,395	99,185	121,895	126,895	132,095
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Supply - Demand (Case#1.1)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(121,017)	(96,869)	(119,400)	(144,569)
Supply - Demand (Case#1.2)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(37,017)	(8,069)	(22,600)	(39,449)
Supply - Demand (Case#1.3)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(68,517)	(41,369)	(58,900)	(78,869)
Supply - Demand (Case#1.4)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(89,517)	(63,569)	(83,100)	(105,149)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity BKK Float Glass	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are
assumed to be equaled and cancelled out
** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Summary Case#1 : No Additional Supplier
(Medium Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	110,501	132,822	154,870	185,380	228,944	267,865	313,402
- Automotive	8,872	9,982	12,976	15,572	17,908	20,056	22,664	26,517	31,024
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	147,053	174,455	201,346	236,625	288,079	335,821	391,568
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi :	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) BKK Float glass	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export (Case#1.1) **	48,085	53,462	61,895	64,895	66,395	130,685	155,195	163,195	171,515
(C) : Export (Case#1.2) **	48,085	53,462	61,895	64,895	66,395	46,685	66,395	66,395	66,395
(C) : Export (Case#1.3) **	48,085	53,462	61,895	64,895	66,395	78,185	99,695	102,695	105,815
(C) : Export (Case#1.4) **	48,085	53,462	61,895	64,895	66,395	99,185	121,895	126,895	132,095
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Supply - Demand (Case#1.1)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(151,110)	(155,374)	(201,116)	(254,783)
Supply - Demand (Case#1.2)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(67,110)	(66,574)	(104,316)	(149,663)
Supply - Demand (Case#1.3)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(98,610)	(99,874)	(140,616)	(189,083)
Supply - Demand (Case#1.4)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(119,610)	(122,074)	(164,816)	(215,363)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity BKK Float Glass	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are
assumed to be equaled and cancelled out
** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Summary Case#2 : With Additional Supplier
(Low Growth Scenario)

(Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	107,556	126,379	143,313	159,651	175,616	193,178	212,495
- Automotive	8,872	9,982	11,231	12,636	14,081	15,692	17,487	19,488	21,717
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	142,362	165,076	185,963	206,532	229,574	254,105	281,354
(B) : Production	144,680	146,030	161,900	171,900	176,900	321,200	398,900	418,900	439,700
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	275,700	353,400	373,400	394,200
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) BKK Float glass	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	105,000	111,000	121,000	131,400
(C) : Export (Case#2.1) **	48,085	53,462	61,895	64,895	66,395	214,685	243,995	259,995	276,635
(C) : Export (Case#2.2) **	48,085	53,462	61,895	64,895	66,395	151,685	177,395	187,395	197,795
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Supply - Demand (Case#2.1)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(100,017)	(74,669)	(95,200)	(118,289)
Supply - Demand (Case#2.2)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(37,017)	(8,069)	(22,600)	(39,449)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity BKK Float Glass	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%

Note : * Inventory at beginning and ending are
assumed to be equaled and cancelled out
** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Summary Case#2 : With Additional Supplier
(Medium Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	110,501	132,822	154,870	185,380	228,944	267,865	313,402
- Automotive	8,872	9,982	12,976	15,572	17,908	20,056	22,664	26,517	31,024
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	147,053	174,455	201,346	236,625	288,079	335,821	391,568
(B) : Production	144,680	146,030	161,900	171,900	176,900	321,200	398,900	418,900	439,700
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	275,700	353,400	373,400	394,200
(B.1) Thai-Asahi'	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) BKK Float glass	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	105,000	111,000	121,000	131,400
(C) : Export (Case#2.1) **	48,085	53,462	61,895	64,895	66,395	214,685	243,995	259,995	276,635
(C) : Export (Case#2.2) **	48,085	53,462	61,895	64,895	66,395	151,685	177,395	187,395	197,795
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Supply - Demand (Case#2.1)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(130,110)	(133,174)	(176,916)	(228,503)
Supply - Demand (Case#2.2)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(67,110)	(66,574)	(104,316)	(149,663)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity BKK Float Glass	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%

Note : * Inventory at beginning and ending are
assumed to be equaled and cancelled out
** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

TABLE OF CONTENTS

LIST OF TABLES

DEMAND FORECAST FOR FLAT GLASS IN THAILAND

CHAPTER I

REVIEW OF THE GDP SERIES FOR THE CONSTRUCTION SECTOR

1. Objective of the Study

The objective of this study is to explore the demand for glass products directly and indirectly related to the glass subsector. Since glass products are utilised mainly by the construction sector, its demand for glass is considered to be the main determinant of demand for the glass sector besides the GDP per se. The total gross output in the construction sector is composed of two main components: the intermediate inputs inclusive of glass products and the value added defined as wage bill, operating surplus, depreciation and indirect tax. In addition, the total demand in the glass sector should be looked at as comprising intermediate demand and final demand for glass products.

The study specifies three chapters:

1. Review of the construction series of GDP.

2. Projection of the growth of the glass sector within the construction sector and other sectors like automotive, glass furniture, etc., to indicate the demand for flat glass for the years 1990 through 1995. Here, we also construct supply-demand balances with respect to various growth scenarios.

3. Implications of new float glass facilities as a result of demand forecasts. In addition, policy recommendations will be drawn also.

The second part is the introduction to the Thai economy, its existing structure and trends. The subsequent section follows the outline mentioned above.

2. Recent Economic Development in Thailand

The Thai economy has entered the phase of light industrialization after a long delay (Chenery, Syrquin and Robinson 1986, and Limskul 1989). In 1987-1989, the average value-added share of the manufacturing sector was 23.31 percent compared with 16.76 percent for the agricultural sector.

The leading light manufacturing sectors are, for example, agro-industry that produces simple agricultural processed products like rice, tapioca, rubber, sugar and frozen shrimp; food processing like canned food, fruit and vegetables; manufactured goods like garments, other textile products and footwears; jewelry; integrated circuits; and non-metal products like cement and ceramics, etc..

After 1985, we observed cyclical upswings in the Thai economy. This is owing partly to the Yen appreciation which helped determine the decision to relocate some industries as a form of direct investment from major countries like Japan, Taiwan and others. It is also due partly to the strength of the Thai economy itself in absorbing this influx. Direct investment from

Japan seems to concentrate more on electrical machinery while Taiwan concentrates more on agroindustry. Recently, Taiwan more to the computer related industry. Thailand responded to this new trend by strengthening her absorption capability by industrial estates and letting private industrial parks develop while facilitating the flow of investment through the BOI machanism.

Investment in infrastructure like electricity, water supply, transport, telecommunication networks and other services have significantly increased through government budget and debt financing from both domestic and international capital markets. Some are in the form of long-term loans like the Yen Loan from the OECF, EXIM Bank, ADB, IBRD etc.. The main core of industrial development in the next decade is planned to be the success in regionalization of industries to provinces other than Greater Bangkok (Bangkok proper and surrounded provinces i.e., Samutraprakan, Nontaburi, Pratumtani and Thonburi area). Moreover, the development of supporting industries like material processing; separate manufacturing operations, e.g. foundry shops, heat-treatment and electro-plating shops; production of moulds and dies, parts and components (including spare or replacement parts), accessories, packaging items such as containers and caps; service industries, e.g. repair work, testing and calibration services (Sukhotanang 1989) as well as basic industries like natural gas and petrochemical complexes. Iron and steel industries (Yoshida 1989) are also key issues in planning.

The Eastern Seaboard Development project will represent the climax in 1990's of the whole process of industrial development in Thailand. The projects involve two main industrial estates at Lam Chabang, Sriracha district, Cholburi province and the Map Ta Put, Rayong province. The former is meant for light industry like electrical machinery parts and some other non-environment degradation industry, while the latter is meant for the petrochemical complex. Both have developed deep-sea ports for the export of finished products and the import of raw materials. The Lam Chabang port is under constuction to finish while the Map Ta Put is in the bidding process. Around these two ports, supporting industries are likely to develop together with the existing agro-industry in the outer periphery provinces like Chaseongsao, Chantaburi, Trad and Prachinburi through private investment, joint ventures and private industrial parks. The impact of the ESD projects is predicted to have a forward linkage in inducing the emergence of industrial development in the southern part of the northeast through the existing road network.

In the upper northeast, exploration for natural gas by ESSO at Nam Pong in the Konkaen province gives rise to a new trend of industrial development in that region. If the gas pipe line is laid along side the Friendship road to Saraburi and Korat, industries that depend on heat consumption are likely to develop. At present, an industrial park in Korat has already

started to develop. Existing industry in the Korat area like bus assembly, parts and accessories will be main impetus to growth apart from the agroindustry such as tapioca pellets and flour. Piped gas will also help to ease the energy consumption of existing ceramic and cement factory in Saraburi at present.

There has been an initiative by Chatchai's government and one OPEC country to set up an industrial complex related to the petroleum products. The complex called "Southern Seaboard Development Projects" is planned around the Krabi province. The idea of a "land bridge" is proposed to facilitate the transport of crude oil and petroleum products between the Andaman and the Gulf of Thailand. In other words, this will facilitate the transportation between the Middle East or Europe with the Far East. The actual financial and physical plan has not materialized at present. More importantly, if the two seaboard project are being launched at the same time, the public investment can not be financed by the Thai government alone. Even joint private investment will be shared by parties concerned about potential economic instability as a result of financial problems owing to public debt and macroeconomic imbalance.

On the supply side, bottlenecks have emerged as constraints to the industrial development process as demand has overheated. The first bottleneck is the inadequacy of public utilities like electricity, water supply, telecommunication networks, ports, container delivery and cargo system, etc.. The

second is the lack of adequate human resouces like engineers, technicians and skilled workers both in terms of quantity and quality.

The imbalance of demand and supply occurs among economic sectors and between urban and rural as well. Disparity of income and wealth among income groups and between rural and urban areas are generally observable even without being quantified empirically. The trend of income inequality will detiorat in 1990's if nothing is done. It is still not clear which way agriculture will be heading; i.e., whether it will become a capital- and technology-intensive agro-business where existing farmers will be just estate laborers.

The issue of agricultural subsidy and inefficiency has been discussed but solutions are not yet found. At present, we are observing the rapid turning of agricultural land area into the industrial parks and other estates in provinces around Greater Bangkok. For example, in Ayudaya province the industrial development is taking place in a northeasternly direction towards Saraburi. A similar scenario may also be taking place in other parts of the country. The implication of this is that first, unskilled labor in the farm area will turn into industrial labor (with some training cost). Second, agriclutural products and wages in both rural and urban areas will rise. Hence, per capita income will likely increase and structual change in consumption patterns will arise. In the long-run, the adjustment of demand

and supply will be managed to follow the direction drafted at present in the 7th Five Year Plan by the National Economic and Social Development Board.

As government policy at present, and perhaps in the coming future, favors the free enterprises system within the environment of the Thai culture and democratic development process, the guidelines to be set in the Plan may not be inconsistent with free enterpise philosophy. However, the issue of who will finance the economic development of Thailand and how will the gains from these developments be apportioned is becoming one of the main issues in determining the development and structural change in Thailand.

3. BUSINESS CYCLE AND RECENT DEVELOPMENT OF THE BUSINESS SITUATION IN THAILAND

Economic recovery in Thailand has been prolonged since the end of 1985. Economic growth rates were recorded at 9.5 and 13.2 percent in 1987 and 1988 compared with 3.5 and 4.9 percent in 1985 and 1986. In 1989, it is generally accepted that Thailand's economic growth in real terms will surpass double digits. The growth has been driven by expansion in various key economic sectors. For instance, in 1989 the agricultural sector grew by at least 5 percent while the manufacturing sector grew by at least 15 percent. In the non-trade sector, the income from

the tourism industry recorded remarkable growth, while the boom in the construction industry contributed to the heating up the economy.

Despite the pressure of the oil price hike, world inflation, increase in interest rates, excess demand for construction materials and various supply bottlenecks in the Thai economy, direct and portfolio foreign investment as well as other short-term capital inflows were still high. Consequently, the adjustment took place in the asset markets particularly land and securities most importantly brought about an inflationary tendency in the economy. The Thai economy, at the macroeconomic level, responded to the inflationary pressure through slowing down of economic activities since the second quarter of 1989. This short-term economic scenario was in fact accurately predicted by our leading indicators since the beginning of 1989. We predicted that the next cyclical peak of the Thai economy would be the last quarter of 1989 (Limskul 1989).

The reference dates shown below indicate that the Thai economy faces short cyclical fluctuations of 51-70 months when measured from one peak to another. The length of the cycles was somewhat shorter when measured from trough to trough. They were as short as 36 and 48 months, except from July 1975 to August 1982 when they were as long as 84 months. It should be noted that the asymmetry between P-T and T-P generally caused the economy to spend more time recovering from full downswings (T) to upswings

(P). In other words, the general macroeconomic activities after the cyclical peaks wear rather volatile. The recession process was rapid, while the recovery process was slower.

Table I-1. Reference Dates of Cycles in Thailand

Peaks	Troughs	Length (month) P-P	P-T	T-P	T-T
-	1971 July				
1974 February	1975 July	-	17	31	48
1979 December	1982 August	70	32	53	84
1984 March	1985 August	51	17	20	36
1989 October		67	-	50	-

Notes: P = Peak ; T = Trough of cycles
P-P indicates length of cycles, from last peak to current peak measured in time scale of month; P-T, T-P and T-T are measured likewise.

In order to forecast short-term fluctuation some quarters ahead, we constructed the diffusion indices. Based on historical diffusion indicies and reference dates we came up with the following series that signifies the components of leading, coincident and lagging diffusion indicies.

As we have mentioned earlier, the recent overheating of the economy was partly caused by the construction boom. It is noteworthy to investigate its relation to total economic activity. By construction, the diffusion index of the

construction sector is composed of various components: the variables which basically belong to the industry domain and other related variables that passed testing procedure. As a reference, we present the historical diffusion index together with the total economy itself.

Table I-2. Component of Leading, Coincident and Lagging Indicators

Leading Indicators:

- Money Supply (M2)
- Stock Price Index (SET index)
- Production of Petroleum
- Production of Iron & Steel
- Price of Tapioca
- No. of firms which are newly estabished & those increase investment
- Price of Gold Bar & Ornament
- Term of Trade

Coincident Indicators:

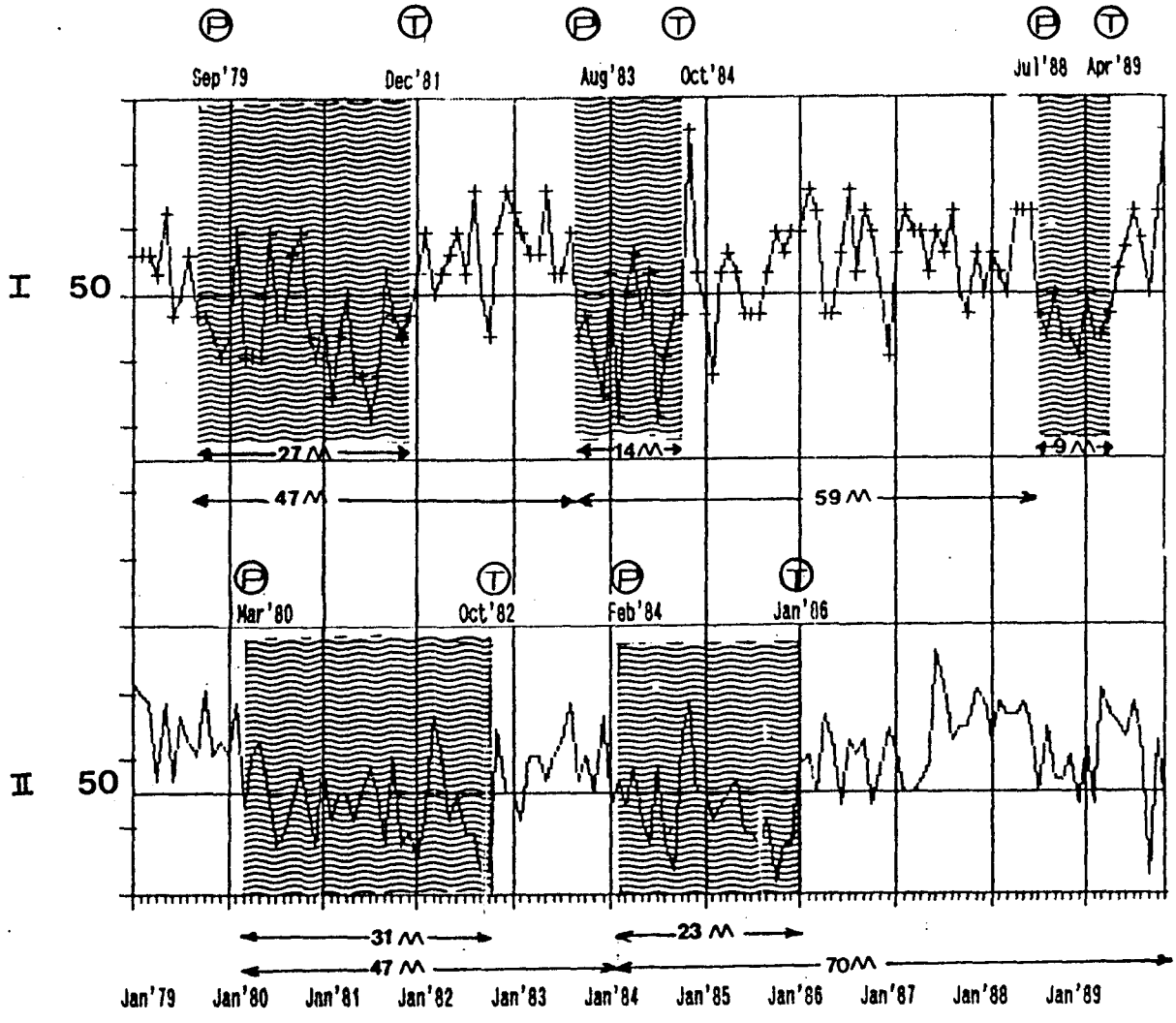
- Production of Tin Concentrates
- Production of Beer
- Production of Gunny Bag
- No. of Cheque clearing
- Export of Crude Materials
- Consumer Price Index of Food Items
- Number of International Tourists
- Wholesale Price of Rubber Grade I
- Government Expenditure Disbursement
- Department Store Sales in BKK
- Export Tax Revenue
- Import Duty Revenue
- Electricity Consumed by Large Users

Lagging Indicator:

- Saving Deposit
- Import Value Index
- Consumption Price Index of Non-Food Items

Diffusion Index (DI)

Thailand Total Economy



I Leading

II Coincident

P Peak

T Trough

As the current inflationary pressure is a result of the economic boom and is becoming a real threat to the next cyclical downswing, we show also the diffusion process of the consumer price index.

The construction cycle has lagged behind the total economic cycle as was generally perceived in Thailand. The consumer price's diffusion process clearly indicates that inflationary pressure (the change in consumer price index) tended to be high (low) when the economy passed through period of cyclical upswings (downswings) with some lag structure. Thus, recent economic upswings in Thailand gave rise to the construction boom as a consequence. It is still lingering on and moving towards its own cyclical peaks. The rate of change of the consumer price index per time period also indicates a rather unstable adjustment process. After June 1988, the pressure of inflation as judged from the rate of change per time period of consumer price index seemed to be significantly increasing.

The leading diffusion index leads the coincident index by 6 months and 15-22 months when measured from peak to peak and trough to trough respectively. The leading diffusion index reached its subsequent peak in July 1988 after exhibiting a long swing since October 1984. It also depicted a short downswing period of 9 months, reaching its trough at April 1989. Given the leading pattern of our diffusion indices, the coincident index exhibited a cyclical peak during last quarter of 1989 as

expected. We believe that this short term movement is a temporary phenomenon.

The Thai economy will be able to track back to a recovery phase again soon. The signal has in fact been observed at the beginning of 1989. For the coming quarters, we make the following predictions. First, the recovery of the leading diffusion index after facing recession of 9 months gives rise to economic downswings in some periods. The current economic condition is likely to enter the phase of downswings and reach cyclical trough not before July 1990 and not later than February 1991. This is judged from the months that the leading index leads the coincident index. With government intervention, however, the recovery may be faster than expected.

The construction sector which lags behind the current economic condition will reach its cyclical peak in due time. It may be reaching its peak as fast as the first quarter of 1991 and as late as the third quarter of the same year. Inflationary pressure is likely to slow down as the current macroeconomy reaches its peak and enters the recession phase in the short-run. After the second quarter of 1990, we may see an re-emergence of inflation after the economy recovers and again enters an upswing period. After the current econmic recovery, the construction sector will enter its cyclical upswing again with some months lagging behind.

4. GDP Growth Series of the Construction Sector

At present the share of construction activities as measured by GDP or value added is 4.33 percent of total GDP at 1972 constant prices. The growth rate of construction GDP, although subjected to the business cycle of the current economy, was found to be 21.30 percent in 1988. Our prediction of this figure for 1989 is not less than 20 percent and, perhaps might be as high as 25.34 pecent, especially as private construction was extraordinarily high. The glass sector (flat glass and other glass products) showed 13.45 percent growth during 1987-1988. We expect a higher growth rate in this sector in 1989 as a result of the construction boom. Owing to the small share of the construction sector in the total present GDP we therefore think that the sector has a tremendous bright future.

The structure of demand in the glass sector is as follows. Almost 68 percent is absorbed by the intermediate demand component induced by inter-industrial relationships while the rest is for the final consumption. In view of its importance to our study the demand forcast for intermediate products in this sector must be carefully developed using some coherent methodology.

The medium-term growth scenario for the GDP series of the construction sector from our forecast with the consideration of the short-term business cycle model cited above is therefore the following:

Table I-3: GDP Series Forecast for the Construction Sector (in percentage per year)

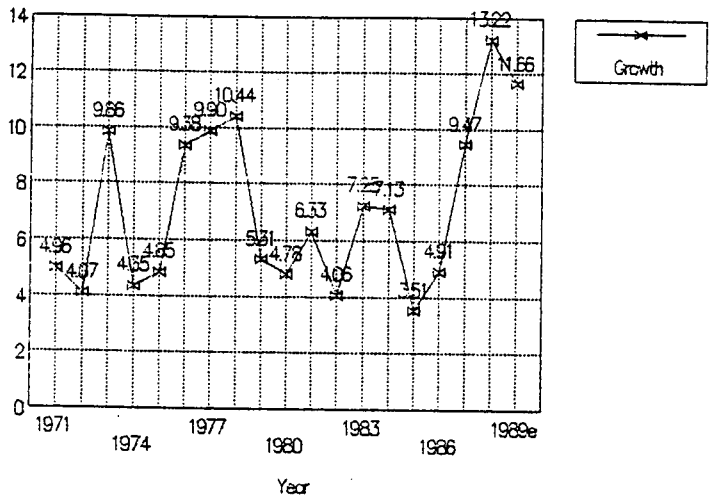
	1989	1990	1991	1992	1993
Agricuture	4.6	3.0	3.5	4.1	4.2
Manufacturing	15.1	12.5	15.2	17.3	18.7
Construction	25.3	20.2	16.6	19.7	23.5
Non-Tradable	10.3	8.6	9.4	10.5	11.2
Economy-wide	11.6	9.5	10.8	12.3	13.5

Source: Annual base CGE model of EPMF programme.

The forecast for 1994 and 1995 is expected to be not less than 17 percent despite possibility of cyclical downswings. However, our prediction is more optimistic. The accuracy of the prediction depends on the accuracy of the short-term business cycle prediction of upswings and downswings or turning points. The business cycle model predicted the turning point correctly at the end of 1985. It also predicted the turning point of cyclical downswing at the end of 1989. We believe the next cycle will also be correctly forecasted.

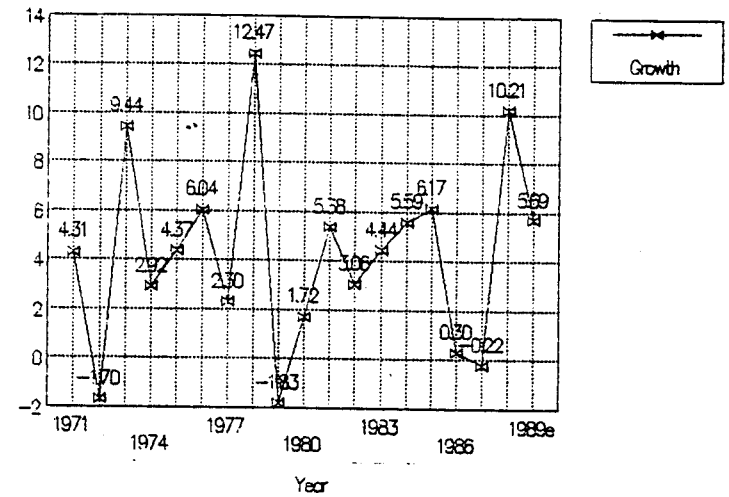
Gross Domestic Product

Growth Rate : 1971-1989e



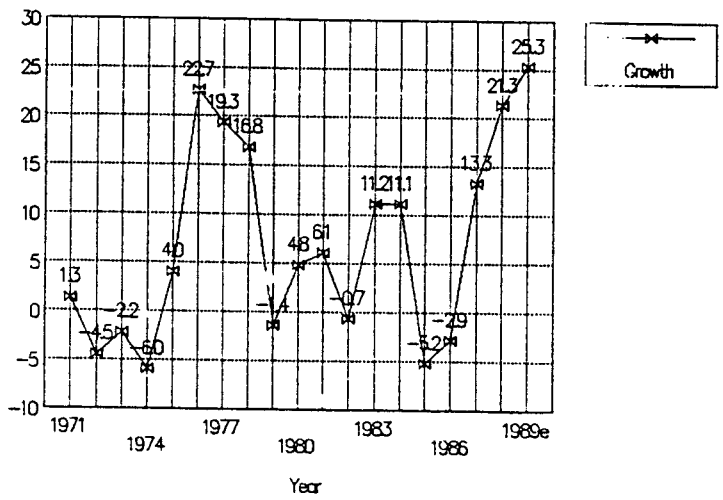
GDP : Agriculture

Growth Rate : 1971-1989e



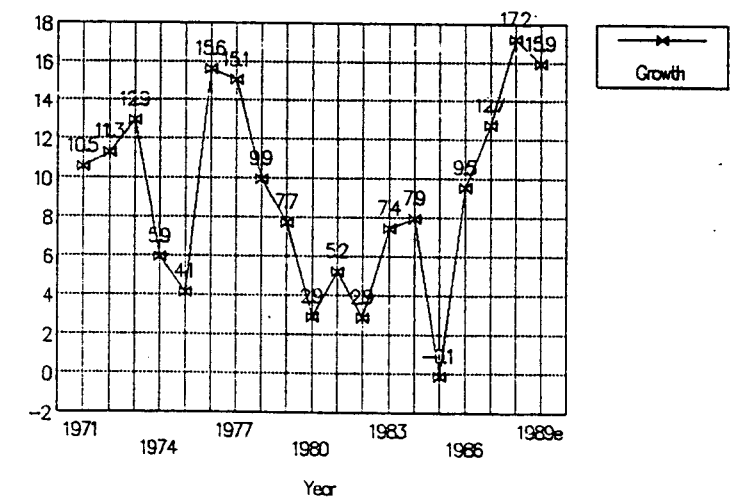
GDP : Construction

Growth Rate : 1971-1989e



GDP : Manufacturing + Mining

Growth Rate : 1971-1989e



CHAPTER II

BALANCE OF SUPPLY-DEMAND FLAT GLASS: 1990-1995

1. Introduction

In this chapter, in order to prove our hypothesis that there is actually excess demand (insufficent flat glass supply) we make a supply demand balance. This is done comparing forecasted demand by the end-users with forecasted production figures very close to actual. The end-users are those sectors which apply flat glass as their intermediate input and as their final consumption. In our study they are aggregated into four main end-users as follows:

1) Architectural related activities.
2) Automotive assembly related activities.
3) Glass furniture activities
4) Others activities that use flat glass

The four main activities constitute the domestic demand for flat glasss. Part of the domestic production is exported according to the statistics. Nevertheless, domestic production cannot totally supply domestic demand. Thus, part of the total domestic demand is supplied by import. For example in 1987, domestic production was 144,680 MT. Domestic demand was 72,680 MT, 8,872 MT, 8,820 MT, and 9,607 MT by architectural, automotive glass furniture and other end-users respectively. This

constitutes the total domestic demand of 99,979 MT in 1987. In the same year, the export of flat glass was 48,085 MT, comprised of sheet glass of 12,825 MT, and float glass of 35,260 MT. Imports were all in the form of float glass of 4,914 MT. The average export price according to the statistics is US$413 per metric ton. The average import price of float glass was US$810 per metric ton.

In 1987, there was only one main supplier; Thai-Asahi. The total capacity of Thai-Asahi was approximately 151,900 MT annually. The capacity for float glass was 131,400 MT per year while it was 20,500 MT a year for plate line (the first factory was not in operation). The actual rate of capacity utilization was, however, around 70% for plate glass and 99% for float glass in 1987. The capacity utilization for plate glass was near full capacity in 1989 and onwards owing to demand expansion.

As a monopoly, Thai-Asahi may set its price schedule at the level that maximizes profit, i.e. set its price high with some excess capacity. Given the demand level, price setting by Thai-Asahi will be such that it will not invite new entry into the market. In such a situation of high demand this price strategy is difficult to maintain. In 1989, there was additional supply of plate glass from Siam Plate Glass with the total capacity of 29,700 MT annually. It is, however, expected that an incoming company will behave as a price follower, i.e. regard accept the price schedule of Thai-Asahi as given and set its own

price so that profit is maximized. Thus, actual production will be somewhat less than the potential maximum capacity.

In 1992, there will be additional supply of float glass from Bangkok Float Glass, a Thai-Asahi related supplier. The potential capacity of Bangkok Float is 131,400 MT annually. During the first 2-3 years of operation, the new supplier may have to climb the learning curve. Thus, output supply in the first 2-3 years will not reach the total potential capacity. Thereafter, with respect to high domestic demand and the BOI-imposed export ratio of 80%, it is likely that Bangkok Float will set the actual production at near its potential maximum.

The demand-supply balance is determined by two main factors. First, the derived growth potential in the Thai economy that induces growth in the end-users demand. Second, the BOI's export ratio which is a policy instrument to direct the balance of domestic demand and supply.

In our study, we hypothesize that there is excess of demand over the domestic production supply. In order to test our hypotheses, we have constructed balance accounts of demand and supply for the period 1990-1995 based on realistic forecasting results in various growth scenarios.

2. Methodology

Two assumptions regarding growth scenarios of the construction, automotive and other glass end-users are shown in Table II-1 below:

Table II-1: End-User Demand Growth Scenarios
(in percentage per year)

	1990	1991	1992	1993	1994	1995
Architectural						
Medium Growth	20.2	16.6	19.7	23.5	17.0	17.0
Low Growth	17.5	13.4	11.4	10.0	10.0	10.0
Automotive						
Medium Growth	20.0	15.0	12.0	13.0	17.0	17.0
Low Growth	12.5	11.4	11.4	11.4	11.4	11.4
Glassed Furniture						
Medium & Low	10.0	9.4	9.2	10.0	10.0	10.0
Others						
Medium & Low	11.2	9.8	9.2	9.0	9.0	9.0

Source: Computed from the GDP series as of the Annual base CGE model of EPMF programme.

The medium and low demand growth scenarios provide the following results:

	SCENARIOS OF DEMAND (in Tons)		
	Medium	Low	Difference
1990	174,455	165,076	9,379
1991	201,346	185,963	15,383
1992	236,625	206,532	30,093
1993	288,079	229,574	58,505
1994	335,821	254,105	81,716
1995	391,568	281,354	110,214

DOMESTIC PRODUCTION

It is assumed that Thai-Asahi produces plate glass with capacity utilization of 100% during 1990-1995. Capacity utilization is also 100% for float production during the same period except the year 1992 when the float line reaches a cycle of maintenance. The Siam Plate produces with capacity utilization of 33.67%, 67.34% in 1989 and 1990 respectively and 84.18% afterwards up to 1995. In addition, Bangkok Float produces with capacity utilization of 80%, 84%, 92%, and 100% during 1992-1995 respectively.

The domestic production or supply of flat glass (plate plus float) is 171,900 MT, 176,900 MT, 216,200 MT, 287,900 MT

297,900 MT and 308,300 MT respectively during 1990-1995. The total supply of float glass is 131,400 MT for 1990 and 1991; and 170,700 MT, 242,400 MT, 252,400 MT, and 262,800 MT from 1992 to 1995 respectively. The supply of plate glass is 40,500 MT in 1990 and 45,500 MT annualy from 1991 to 1995. Thai-Asahi supply of float glass is 131,400 MT in 1990 and 1991, 65,700 MT in 1992 and 131,400 MT during 1993-1995. In 1992, additional supply of float glass from Bangkok Float is 105,000 MT, rising to 111,000 MT in 1993 and 121,000 MT and 131,400 MT in 1994 and 1995 respectively.

DOMSESTIC SUPPLY POTENTIALS
(in Tons)

	Plate	Float	Total
1990	40,500	131,400	171,900
1991	45,500	131,400	176,900
1992	45,500	170,700	216,200
1993	45,500	242,400	287,900
1994	45,500	252,400	297,900
1995	45,500	262,800	308,300

From these supply-demand growth scenarios we have constructed a balance sheet of demand and supply 1990-1995. In each medium and low growth scenario we have made experiments (hereinafter called Cases) to test whether will be excess demand

or supply. In addition, we try to identify where the export ratio should by BOI to assure that there will not be excess demand in the medium-run.

3. Flat Glass Industry Supply-Demand Balance: 1990-1995

3.1 Medium Growth Scenario

In the medium growth scenario, all cases of demand and supply balance exhibit an excess of demand over supply throughout the entire period 1990-1995. The results are as follows:

WITHOUT ADDITIONAL SUPPLIER

Case 1.1: Given export ratio of 80% for Bangkok Float. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	67,450
1991	90,841
1992	151,110
1993	155,374
1994	201,116
1995	254,783

Case 1.2: Given export ratio of 0%, i.e. no export for Bangkok Float. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	67,450
1991	90,841
1992	67,110
1993	66,574
1994	104,316
1995	149,663

Case 1.3: Given export ratio of 30% for Bangkok Float. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	67,450
1991	90,841
1992	98,610
1993	99,874
1994	140,616
1995	189,083

Case 1.4: Given export ratio of 50% for Bangkok Float. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	67,450
1991	90,841
1992	119,610
1993	122,074
1994	164,816
1995	215,363

WITH ADDITIONAL SUPPLIER

Case 2.1: Given export ratio of 80% for Bangkok Float and additional supplier. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	67,450
1991	90,841
1992	130,110
1993	133,174
1994	176,916
1995	228,503

Case 2.2: Given export ratio of 50% for Bangkok Float and additional supplier. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	67,450
1991	90,841
1992	67,110
1993	66,574
1994	104,316
1995	149,663

3.2 Low Growth Scenario

These cases are shown in order to explore the balance of demand and supply in an unexpected situation where overall growth rates of the economy, the construction sector and other glass end-users are lower than that assumed in the medium growth scenario. The balance of demand over supply are as follows.

WITHOUT ADDITIONAL SUPPLIER

Case 1.1: Given export ratio of 80% for Bangkok Float. Thai-Asahi keeps on exporting 30% for float and 95% for plate

glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	58,071
1991	75,458
1992	121,017
1993	96,896
1994	119,400
1995	144,569

Case 1.2: Given export ratio of 0% i.e., no export for Bangkok Float. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	58,071
1991	75,458
1992	37,017
1993	8,069
1994	22,600
1995	39,449

Case 1.3: Given export ratio of 30% for Bangkok Float. Thai-Asahi keeps on exporting 30% for float and 95% for plate

glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	58,071
1991	75,458
1992	68,517
1993	41,369
1994	58,900
1995	78,869

Case 1.4: Given export ratio of 50% for Bangkok Float. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	58,071
1991	75,458
1992	89,517
1993	63,569
1994	83,100
1995	105,149

WITH ADDITIONAL SUPPLIER

Case 2.1: Given export ratio of 80% for Bangkok Float and additional supplier. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	58,071
1991	75,458
1992	100,017
1993	74,669
1994	95,200
1995	118,289

Case 2.2: Given export ratio of 50% for Bangkok Float and additional supplier. Thai-Asahi keeps on exporting 30% for float and 95% for plate glass while Siam Plate Glass exports 30% of their production.

RESULTS	EXCESS OF DEMAND OVER SUPPLY (in Tons)
1990	58,071
1991	75,458
1992	37,017
1993	8,069
1994	22,600
1995	39,449

From the foregoing results under the low growth scenario, we may make the following summary.

WITHOUT ADDITIONAL SUPPLIER

In case Bangkok Float has to comply with the BOI condition of 80% export ratios, even under the scenario of low growth of demand it is found that excess demand exists from 1992 to 1995 (Ref. Case 1.1). The excess demand is 121,017 MT, 96,869 MT, 119,400 MT and 144,569 MT respectively during the period 1992-1995.

We have tried to experiment with counterfactural assumptions that if the Bangkok Float is allowed to supply (i) 100% of production to domestic market i.e., no export (Ref. Case 1.2); (ii) the export ratio for Bangkok Float is 30% (Ref. Case 1.3); (iii) the export ratio of Bangkok Float is 50% (Ref. Case 1.4), while the Thai-Asahi and the Siam Plate behave normally. It is found that excess demand still exists during 1992-1995.

WITH ADDITIONAL SUPPLIER

We assumed that an additional supplier is allowed to enter the market and tested the viability of the industry. We find that there are large margins of excess demand even in the low growth scenario. In the case of requiring the additional supplier to comply with the existing BOI condition, i.e. 80% export ratio; we

find that the excess demand is 100,017 MT, 74,669 MT, 95,200 MT and 118,289 MT respectively for the period 1992 to 1995.

We made another counterfactural assumption that if Bangkok Float and the new supplier are allowed to supply 50% of their production to the domestic market, i.e. 50% export ratio. Under this case, we find that there is severe excess demand for flat glass in Thailand. The execess demand is 37,017 MT, 8,069 MT, 22,600, nd 39,449 MT for the period 1992 to 1995 respectively.

4. Conclusions

(1) The Thai economy has fundamentally taken-off into a sustainable growth phase. Although it may face some cyclical downswings up to the end of 1990, the economy is likely to grow on a firm basis into the year 2000.

(2) The favorable growth trend in the export and manufacturing sector has given rise to excess demand for housing and office buildings in the construction sector. In addition, durable goods like automotive are becoming one of the fast growing sectors in Thailand.

(3) The derived demand in the glass sector, especially the flat glass industry, is generally accepted to be very substantial. However, at present there is only one price leader, Thai-Asahi, and one price follower, Siam Plate. It is clear that the two suppliers will have a significant degree of monopolistic

power. This can be seen also from the fact that unit price of imported float glass is 2-3 times as high as the export price. Given the quality difference between the imported and exported glass products, export price is more closely aligned to domestic price schedule. Also, Thailand will lose foreign exhange earnings if domestic demand has to be fulfilled by imports from abroad due to insufficient local supply.

(4) The experiments undertaken in this study are as follows. The realistic figures of demand and supply are first obtained from existing statistics and counterfactural assumptions of the glass sector in Thailand. We find that in the present state of the industry, it is clear that there is excess demand. If this is not remedied, it will have unfavorable effects on the construction sector. The critical lack of supply of flat glass is forecast to continue up to the year 1995. The entry of Bangkok Float in 1992 will solve part of the problem. It will be necessary to gear up additonal domestic supply. However, in the present state of the industry, all existing suppliers are already operating at near full capacity and no additional supply will be available up to 1995. Consequently, the total problem of excess demand cannot be solved without an increase in supply in the glass industry. This can be accomplished either by allowing additional investment in domestic manufacture or by continuing to import increasing quantities of float glass at high cost and foreign exchange loss.

(5) After allowing additional production with normal capacity assumptions and also assuming an export ratio as high as 80%, we still find a situation of excess demand throughout 1992-1995.

It is also certain that the BOI's instrument of export ratios alone is unable to cope with the excess demand problem without allowing of new entries (Ref. Case 1.2).

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#1.1 : No Additional Supplier, with Export Ratio 80% for Bangkok Float

(Medium Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	110,501	132,822	154,870	135,380	228,944	267,865	313,402
- Automotive	8,872	9,982	12,976	15,572	17,908	20,056	22,664	26,517	31,024
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	147,053	174,455	201,346	236,625	288,079	335,821	391,568
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export **	48,085	53,482	61,895	64,895	66,395	130,685	155,195	163,195	171,515
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	84,000	88,800	96,800	105,120
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(151,110)	(155,374)	(201,116)	(254,783)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#1.2 : No Additional Supplier, No Export for Bangkok Float

(Medium Growth Scenario) (Tons)

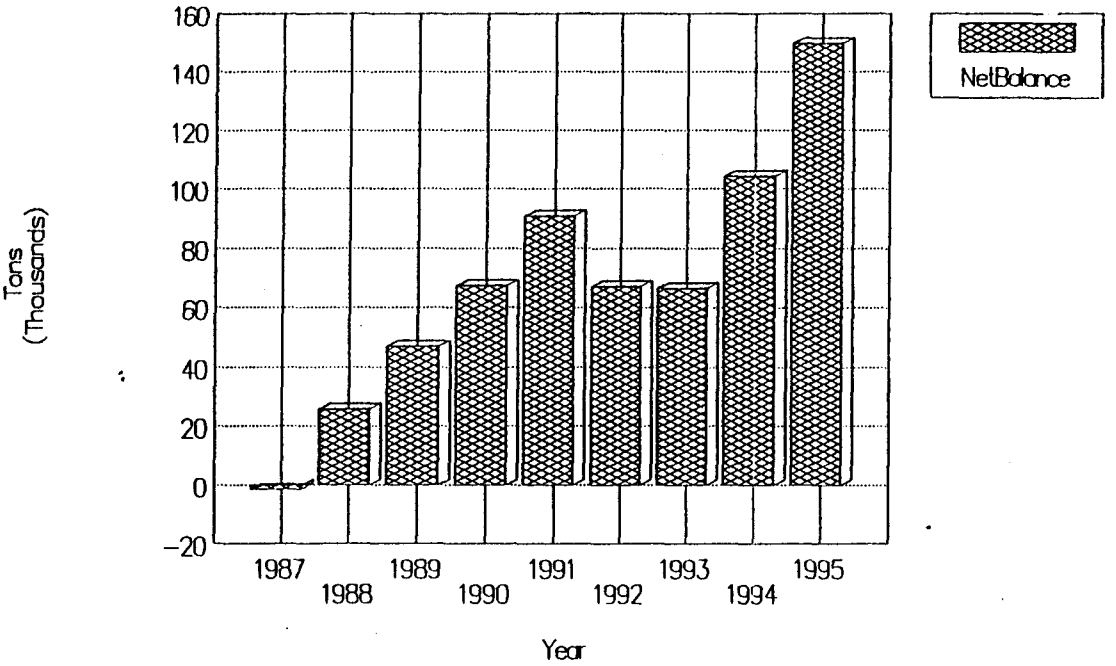
ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	110,501	132,822	154,870	185,380	228,944	267,865	313,402
- Automotive	8,872	9,982	12,976	15,572	17,908	20,056	22,664	26,517	31,024
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	147,053	174,455	201,346	236,625	288,079	335,821	391,568
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export **	48,085	53,462	61,895	64,895	66,395	46,685	66,395	66,395	66,395
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	0	0	0	0
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(67,110)	(66,574)	(104,316)	(149,663)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

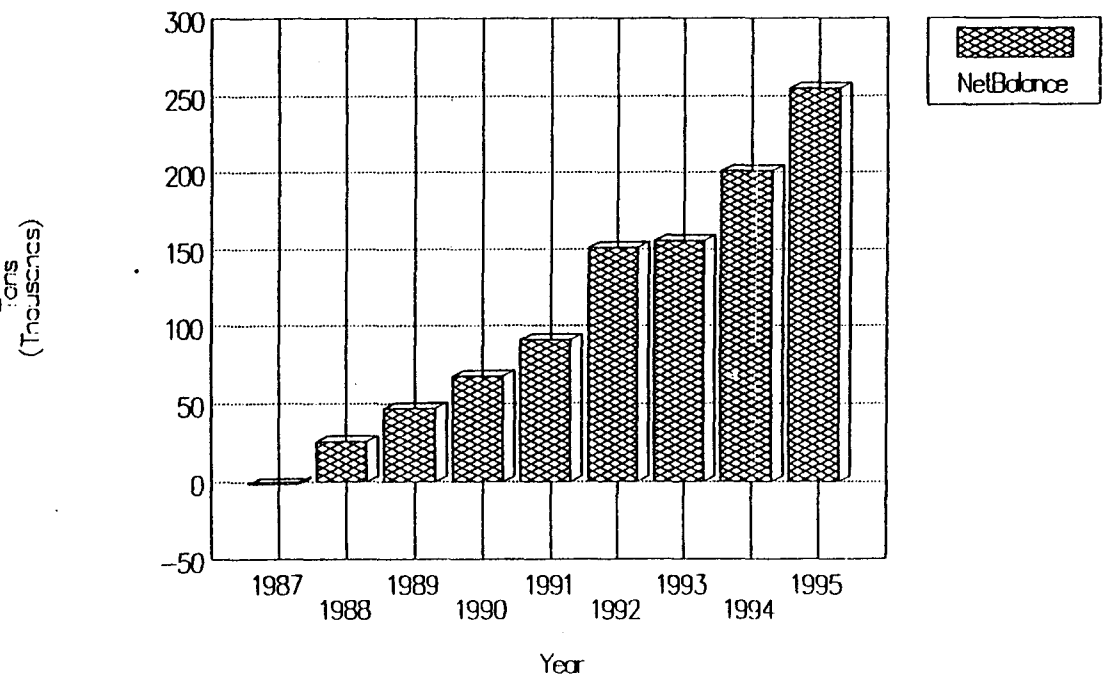
Demand – Supply Balance

Case #1.2 (Medium Growth)



Demand – Supply Balance

Case #1.1 (Medium Growth)



Flat Glass Industry Demand-Supply Balance, 1987-1995

Case#1.3 : No Additional Supplier, with Export Ratio 30% for Bangkok Float

(Medium Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	110,501	132,822	154,870	195,380	228,944	267,865	313,402
- Automotive	8,872	9,982	12,976	15,572	17,901	20,056	22,664	26,517	31,024
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	147,053	174,455	201,346	236,625	288,079	335,821	391,568
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export **	48,085	53,462	61,895	64,895	66,395	78,185	99,695	102,695	105,815
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	31,500	33,300	36,300	39,420
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(98,610)	(99,874)	(140,616)	(189,083)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#1.4 : No Additional Supplier, with Export Ratio 50% for Bangkok Float

(Medium Growth Scenario) (Tons)

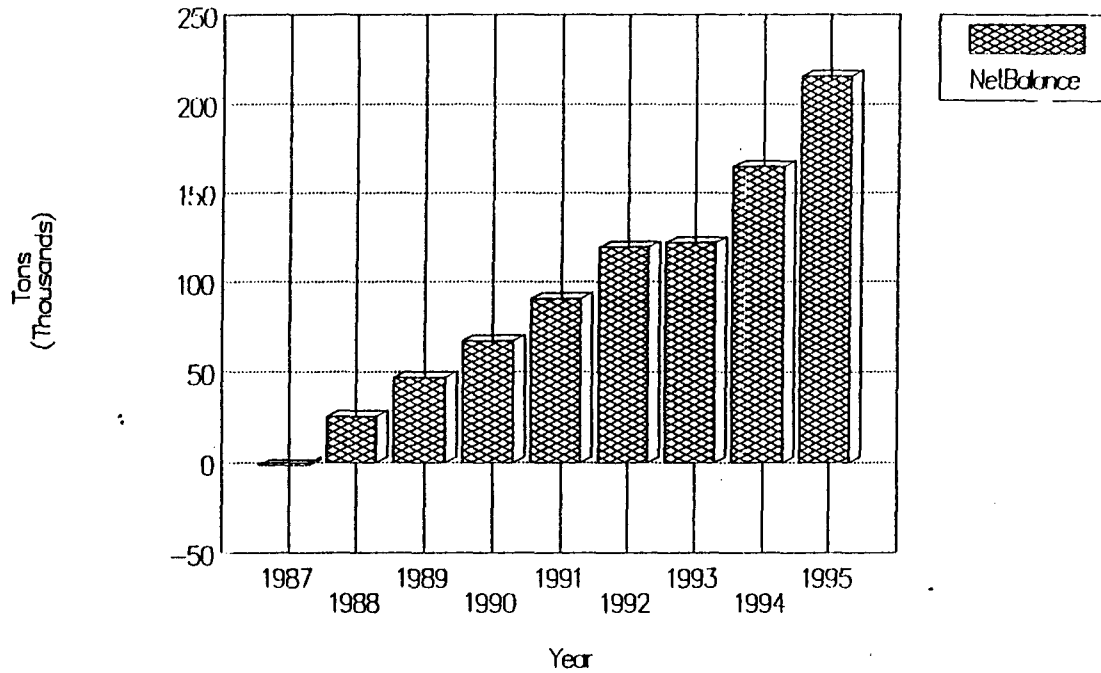
ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	110,501	132,822	154,870	185,380	228,944	267,865	313,402
- Automotive	8,872	9,982	12,976	15,572	17,908	20,056	22,664	26,517	31,024
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	147,053	174,455	201,346	236,625	288,079	335,821	391,568
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export **	48,085	53,462	61,895	64,895	66,395	99,185	121,895	126,895	132,095
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	52,500	55,500	60,500	65,700
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(119,610)	(122,074)	(164,816)	(215,363)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

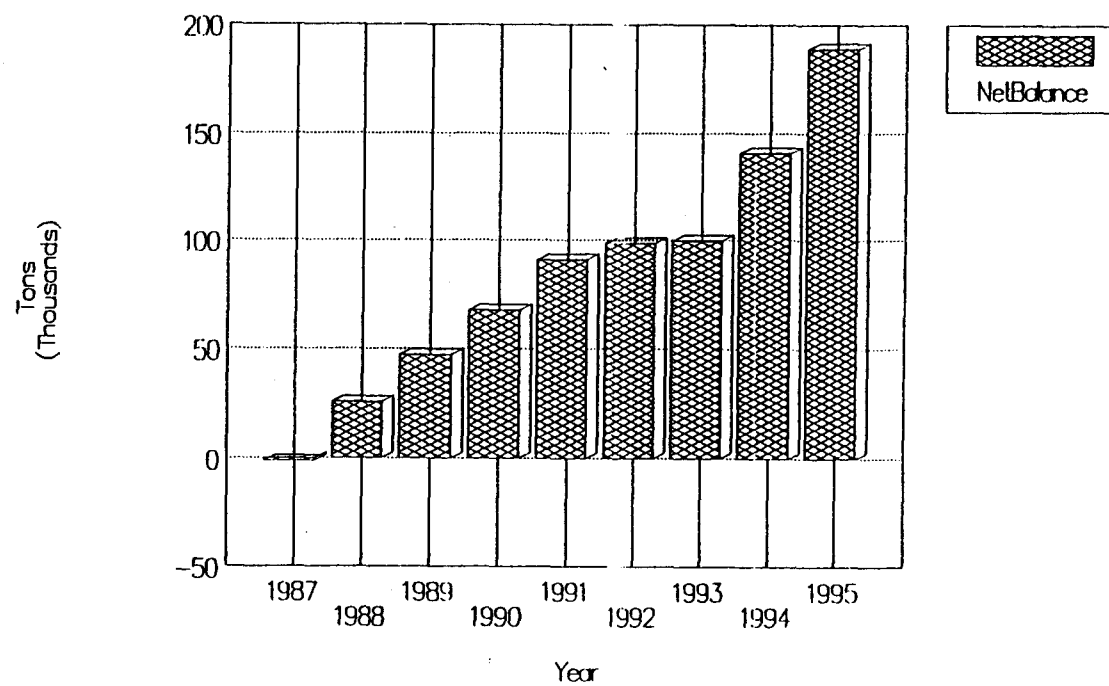
Demand – Supply Balance

Case #1.4 (Medium Growth)



Demand – Supply Balance

Case #1.3 (Medium Growth)



Flat Glass Industry Demand-Supply Balance, 1987-1995

Case#2.1 : With Additional Supplier, with Export Ratio 80% for Bangkok Float and Additional Supplier
(Medium Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	110,501	132,822	154,870	185,380	228,944	267,865	313,402
- Automotive	8,872	9,982	12,976	15,572	17,908	20,056	22,664	26,517	31,024
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	147,053	174,455	201,346	236,625	288,079	335,821	391,568
(B) : Production	144,680	146,030	161,900	171,900	176,900	321,200	398,900	418,900	439,700
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	275,700	353,400	373,400	394,200
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	105,000	111,000	121,000	131,400
(C) : Export **	48,085	53,462	61,895	64,895	66,395	214,685	243,995	259,995	276,635
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	84,000	88,800	96,800	105,120
- Add. Float Supplier	0	0	0	0	0	84,000	88,800	96,800	105,120
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(130,110)	(133,174)	(176,916)	(228,503)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%

Note : * Inventory at beginning and ending are
assumed to be equaled and cancelled out
** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#2.2 : With Additional Supplier, with Export Ratio 50% for Bangkok Float and Additional Supplier

(Medium Growth Scenario) (Tons)

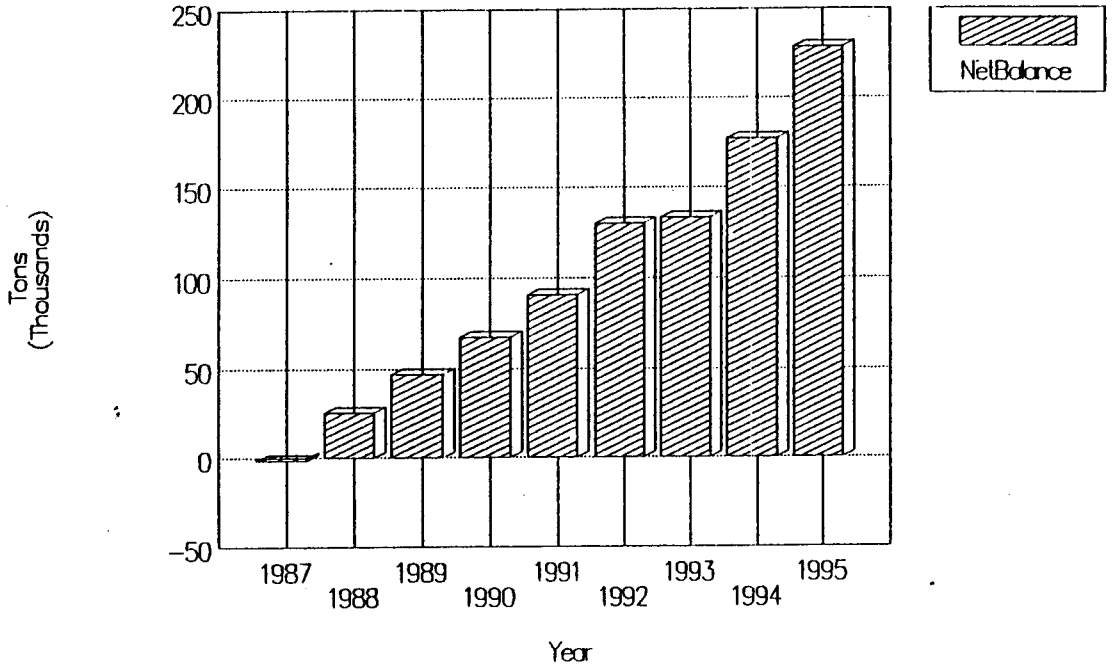
ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	110,501	132,822	154,870	185,380	228,944	267,865	313,402
- Automotive	8,872	9,982	12,976	15,572	17,908	20,056	22,864	26,517	31,024
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	147,053	174,455	201,346	236,625	288,079	335,821	391,568
(B) : Production	144,680	146,030	161,900	171,900	176,900	321,200	398,900	418,900	439,700
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	275,700	353,400	373,400	394,200
(B.1) Thai-Asahi :	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	105,000	111,000	121,000	131,400
(C) : Export **	48,085	53,462	61,895	64,895	66,395	151,685	177,395	187,395	197,795
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	52,500	55,500	60,500	65,700
- Add. Float Supplier	0	0	0	0	0	52,500	55,500	60,500	65,700
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(47,048)	(67,450)	(90,841)	(67,110)	(66,574)	(104,316)	(149,663)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

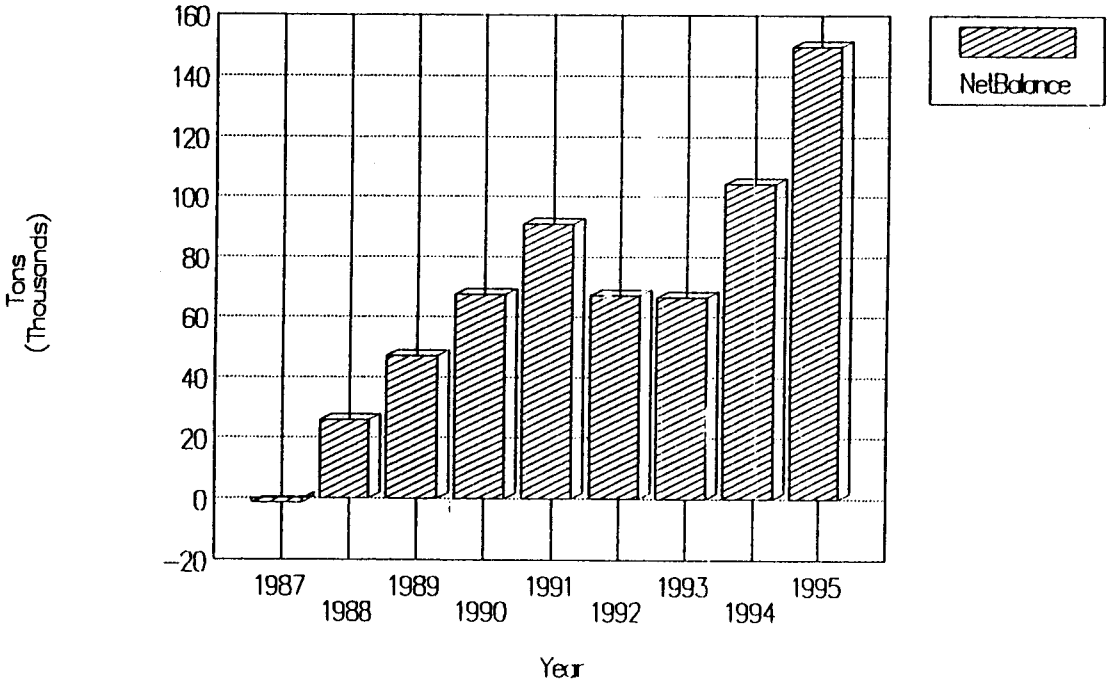
Demand – Supply Balance

Case #2.1 (Medium Growth)



Demand – Supply Balance

Case #2.2 (Medium Growth)



Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#1.1 : No Additional Supplier, with Export Ratio 80% for Bangkok Float

(Low Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	107,556	126,379	143,313	159,651	175,616	193,178	212,495
- Automotive	8,872	9,982	11,231	12,636	14,081	15,692	17,487	19,488	21,717
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	142,362	165,076	185,963	206,532	229,574	254,105	281,354
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export **	48,085	53,462	61,895	64,895	66,395	130,685	155,195	163,195	171,515
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	84,000	88,800	96,800	105,120
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(121,017)	(96,869)	(119,400)	(144,569)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#1.2 : No Additional Supplier, No Export for Bangkok Float
(Low Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	107,556	126,379	143,313	159,651	175,616	193,178	212,495
- Automotive	8,872	9,982	11,231	12,636	14,081	15,692	17,487	19,488	21,717
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	142,362	165,076	185,963	206,532	229,574	254,105	281,354
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export **	48,085	53,462	61,895	64,895	66,395	46,685	66,395	66,395	66,395
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	0	0	0	0
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(37,017)	(8,069)	(22,600)	(39,449)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are
assumed to be equaled and cancelled out
** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#1.3 : No Additional Supplier, with Export Ratio 30% for Bangkok Float

(Low Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	107,556	126,379	143,313	159,651	175,616	193,178	212,495
- Automotive	8,872	9,982	11,231	12,636	14,081	15,692	17,487	19,488	21,717
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	142,362	165,076	185,963	206,532	229,574	254,105	281,354
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export **	48,085	53,462	61,895	64,895	66,395	78,185	99,695	102,695	105,815
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	31,500	33,300	36,300	39,420
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(68,517)	(41,369)	(58,900)	(78,869)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#1.4 : No Additional Supplier, with Export Ratio 50% for Bangkok Float

(Low Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	107,556	126,379	143,313	159,651	175,616	193,178	212,495
- Automotive	8,872	9,982	11,231	12,636	14,081	15,692	17,487	19,488	21,717
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	142,362	165,076	185,963	206,532	229,574	254,105	281,354
(B) : Production	144,680	146,030	161,900	171,900	176,900	216,200	287,900	297,900	308,300
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	170,700	242,400	252,400	262,800
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	0	0	0	0
(C) : Export **	48,085	53,462	61,895	64,895	66,395	99,185	121,895	126,895	132,095
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	52,500	55,500	60,500	65,700
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(89,517)	(63,569)	(83,100)	(105,149)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#2.1 : With Additional Supplier, with Export Ratio 80% for Bangkok Float and Additional Supplier
(Low Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	107,556	126,379	143,313	159,651	175,616	193,178	212,495
- Automotive	8,872	9,982	11,231	12,636	14,081	15,692	17,487	19,488	21,717
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	142,362	165.076	185,963	206,532	229,574	254,105	281,354
(B) : Production	144,680	146,030	161,900	171,900	176,900	321,200	398,900	418,900	439,700
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	275,700	353,400	373,400	394,200
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	105,000	111,000	121,000	131,400
(C) : Export **	48,085	53,462	61,895	64,895	66,395	214,685	243,995	253,995	276,635
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	84,000	88,800	96,800	105,120
- Add. Float Supplier	0	0	0	0	0	84,000	88,800	96,800	105,120
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(100,017)	(74,669)	(95,200)	(118,289)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%

Note : * Inventory at beginning and ending are assumed to be equaled and cancelled out

** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

Flat Glass Industry Demand-Supply Balance. 1987-1995

Case#2.2 : With Additional Supplier, with Export Ratio 50% for Bangkok Float and Additional Supplier
(Low Growth Scenario) (Tons)

ITEMS	1987	1988	1989	1990	1991	1992	1993	1994	1995
End-Used Demand									
- Architectural	72,680	88,161	107,556	126,379	143,313	159,851	175,818	193,178	212,495
- Automotive	8,872	9,982	11,231	12,636	14,081	15,692	17,487	19,488	21,717
- Glassed Furniture	8,820	11,290	12,983	14,281	15,631	17,067	21,078	24,661	28,854
- Others	9,607	8,827	10,592	11,780	12,938	14,122	15,393	16,778	18,288
(A) : Total End-Used Demand	99,979	118,259	142,362	165,076	185,963	206,532	229,574	254,105	281,354
(B) : Production	144,680	146,030	161,900	171,900	176,900	321,200	398,900	418,900	439,700
- Plate	13,500	14,850	30,500	40,500	45,500	45,500	45,500	45,500	45,500
- Float	131,180	131,180	131,400	131,400	131,400	275,700	353,400	373,400	394,200
(B.1) Thai-Asahi	144,680	146,030	151,900	151,900	151,900	86,200	151,900	151,900	151,900
- Plate	13,500	14,850	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,180	131,180	131,400	131,400	131,400	65,700	131,400	131,400	131,400
(B.2) Siam Plate glass	0	0	10,000	20,000	25,000	25,000	25,000	25,000	25,000
(B.3) Bangkok Float	0	0	0	0	0	105,000	111,000	121,000	131,400
(B.4) Add. Float Supplier	0	0	0	0	0	105,000	111,000	121,000	131,400
(C) : Export **	48,085	53,462	61,895	64,895	66,395	151,685	177,395	187,395	197,795
- Thai-Asahi Float	35,260	39,354	39,420	39,420	39,420	19,710	39,420	39,420	39,420
- Bangkok Float	0	0	0	0	0	52,500	55,500	60,500	65,700
- Add. Float Supplier	0	0	0	0	0	52,500	55,500	60,500	65,700
- Thai-Asahi Plate	12,825	14,108	19,475	19,475	19,475	19,475	19,475	19,475	19,475
- Siam Plate	0	0	3,000	6,000	7,500	7,500	7,500	7,500	7,500
(D) : Imports	4,914	0	0	0	0	0	0	0	0
(E) : Beginning Inventory *									
(F) : Ending Inventory *									
Excess Supply (Excess Demand) (B)-(A)-(C)+(D)+(E)+(F)	1,530	(25,691)	(42,357)	(58,071)	(75,458)	(37,017)	(8,069)	(22,600)	(39,449)
Total Capacity	151,900	151,900	181,600	181,600	181,600	444,400	444,400	444,400	444,400
(G) Capacity Thai-Asahi	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900	151,900
- Plate	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
- Float	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400	131,400
(H) Capacity Siam Plate Glass	0	0	29,700	29,700	29,700	29,700	29,700	29,700	29,700
(I) Capacity Bangkok Float	0	0	0	0	0	131,400	131,400	131,400	131,400
(J) Capacity Add. Float Supplier	0	0	0	0	0	131,400	131,400	131,400	131,400
Capacity Utilization									
(B.1)/(G)	95.25%	96.14%	100.00%	100.00%	100.00%	56.75%	100.00%	100.00%	100.00%
- Plate	65.85%	72.44%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
- Float	99.83%	99.83%	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%
(B.2)/(H)	0.00%	0.00%	33.67%	67.34%	84.18%	84.18%	84.18%	84.18%	84.18%
(B.3)/(I)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%
(B.4)/(J)	0.00%	0.00%	0.00%	0.00%	0.00%	79.91%	84.47%	92.09%	100.00%

Note : * Inventory at beginning and ending are
assumed to be equaled and cancelled out
** Assumed export ratio of 30% (Float),95% (Plate) for Thai-Asahi and 30% for Siam-Plate accordingly

CHAPTER III

IMPLICATIONS OF FINDINGS & POLICY RECOMMENDATIONS

1. IMPLICATIONS OF FINDINGS ON THE FLOAT GLASS INDUSTRY

ECONOMIC IMPLICATIONS

(1) The persistent existence of excess demand proved in Chapter II implies the inefficiency of the industry. This is mainly due to the allowance of a monopoly.

(2) The existence of a monopoly gives rise to a high supply price and/or less quantity supplied to the market to artificially inflate demand in the short to medium term. In the longer-run, there will be continued insufficient supply because new entries will be blocked. Severe shortage is a clear consequence, especially, when demand is being driven so high as is happening now.

(3) From an optimal social point of view, the economic implication of our findings is simply that float glass facilities should be increased. In this way, the medium to long term imbalance of demand and supply will be solved. In addition, the inflationary effect caused by glass shortage that would spill over from the booming construction sector will be reduced.

2. POLICY RECOMMENDATIONS

(1) In our study, it is recommended that additional suppliers are needed to solve the severe problem of supply shortage. The starting date of supply should not be later than early 1992 if government does not want severe excess demand to occur. Since the time lag of factory construction, machine and furnace installation in this industry is 20-24 months, an early decision is needed to assure additional supply by 1992. In our study, encouraging additional suppliers is an optimal solution to solve the problem of excess demand up to at least 1995.

(2) It is also recommended that the industry should exhibit more efficiency by encouraging competition through pricing policy.Given the variations in supply shortage between the medium and low growth scenarios, we recommend that the BOI should establish export ratios that would provide stability of supply to the domestic market and viability for the industry.

(3) It is recommended that a significant degree of technology level should be set as a precondition of entrance in addition to the BOI export ratios.

The encouragement of new entries will assure the desired favorable results. It should guarantee that supply price will be lowered, output will be increased and more efficient technology will be introduced.

REFERENCES

Ajanant, J. (1987), "Trade Patterns and Trends of Thailand," in C.I. Bradford, Jr., and W.H. Branson ed., Trade and Structural Change in Pacific Asia, NBER's Conference Report, University of Chicago Press.

Ajanant, J., Chunanuntathum S., and Meenaphand, S. (1986), Trade and Industrialization of Thailand, Social Science Association of Thailand, Bangkok, Thailand.

Akrasanee, N. (1975), "Industrialization and Trade Policies and Employment Effects in Thailand," in N. Akrasanee and S. Naya and V. Vichit-Vadakkan Trade and Employment in Asia and the Pacific, The Council for Asian Manpower Studies, Manila. United Nations Asian Development Insitute, Bangkok.

Akrasanee, N. (1981), "Trade Strategy for Employent Growth in Thailand," in A.O. Kruger, H.B. Lary, T. Monson and N. Akrasanee, Trade and Employment in Developing Countries, Vol.1 Individual Studies, NBER.

Amachree, S. M. O. (1988), Investment Appraisal in Developing Countries, Gower Publishing Company Limited.

Newspaper Article (1990), "Pramarn Orders Review of GLass Plant Ban," Bangkok Post, February 7th, 1990

Newspaper Article (1990), "Building Boom Affects Ceramics: Listed Ceramic Firms Stand to Benefit," Bangkok Post, February 12th, 1990

Chenery, H.B., Robinson, R., and Syrquin, M. (1986), Industrialization and Growth: A Comparative Study, A World Bank Research Publication, Oxford University Press.

Chenery, H.B., and Syrquin, M. (1975), Patterns of Development 1950-1970, A World Bank Research Publication, Oxford University Press

De Melo, J.(1985), "Sources of Growth and structural Change in the Republic of Korea and Taiwan: Some Comparison," in V. Corbo, A.o. Krueger, and F. Ossa ed., Export-Oriented Development Strategies, Westview Special Studies in Social, Political, and Economic Development, Westview Press.

Dervis, K.,De Melo, J., and Robinson S.(1982) General Equilibrium Model for Development Policy, Cambridge University Press.

Ezaki, M.(1985), "Growth According Base on Input-Output Tabels," in United States, Economic and Social Comision For Asia and Pacific, Input-Output Model: Theory,Data and Application.

Ezaki, M.(1987), Development Planning and Polities in ASEAN Countries, Center for South East Asian Studied, Kyoto. University.

Ikemoto, Y. (1985), "Technical Progress and Level of Technology in Asian Countries,1970-1980: A Translog Index Approach, The Developing Economies. Vol.XXIV, No.4, December.

Insitute of Development Economic (1975), Development of Manufacturing in Korea in the 1960's: A Statistical Analysis. I.D.E. Statistical Data Series No. 17.

Khantigaroon, K. (1989), Business Condition in Construction Industry, A Short Report (in Thai), Economic Policy Modelling and Forecasting Programme, Chulalongkorn University Social Research Institute, Bangkok, Thailand.

Klein, P.H. and Moore, G.H. (1985), Monitoring Growth Cycles in Market Oreinted Countires, Developing and Using International Economic Indicators, National Bureau of Economic Research Studies in Business Cycles, No. 26.

Kim, K.S., and Roemer, M. (1979), Growth and Structure Transformation, Studies in the Modernization of the Republic of Korea: 1945-1975, Harvard East Asian Monograph 86, Public Council on East Asia Studies, Harvard University.

Kubo, Y., Robinson, S., and Syrquin (1986), "The Metholodogy of Multisector Comparative Analysis," in H.B. Chenery, S. Robinson, and M. Syrquin (1986), Industrialization and Growth: A Comparative Study, A World Bank Research Publication, Oxford University Press.

Kubo, Y., De Melo, J., and Robinsion, R. (1986), "Trade Strategy and Growth Episodes," in H.B. Chenery, S. Robinson, and M. Syrquin (1986), Industrialization and Growth: A Comparative Study, A World Research Publication, Oxford University Press Bank Research Publication, Oxford University.

Kubo, Y., De Melo, J., Robinson, R., and Syrquin M. (1986), "Interdependence and Industrial Structure," in H.B. Chenery, S. Robinson, and M. Syrquin (1986), Industrialization and Growth: A Comparative Study, A World Bank Research Publication, Oxford University Press.

Limskul, K. (1988a), "Sources of Economic Growth Owing to the Labor Quality," in Kitti Limskul (1988), Economic Development and Structural Change in Thailand, A Doctor of Economic Thesis, Faculty of Economics, Nagoya University, Japan.

Limskul, K. (1988b), "Sectoral Capital Stock, Employment, and Sources of Growth in Thailand, 1960-1986," in Kitti Limskul (1988a), Economic Development and Structural Change in Thailand, A Doctor of Economic Thesis, Faculty of Economics, Nagoya University, Japan.

Limskul, K. (1988c), Economic Development and Structural Change in Thailand, A Doctor of Economic Thesis, Faculty of Economics, Nagoya University, Japan.

Limskul K. (1989a),"Thai Economy in 1989," in Sampakorn San,(in Thai) ,Series 36, No.1, January 1989.

Limskul, K. (1989b), "Sources of Economic Growth and Causes of Structural Change in Thailand," (in Thai), Chulalongkorn Journal of Economics, Volume 1, No. 2 (August).

Limskul, K. and Khantigaroon, T. (1989), Construction of International Trade Indicies, A Research Report to Ministry of Commerce (in Thai), Economic Policy Modelling and Forecasting Programm, Chulalongkorn University Social Research Institute, Bangkok, Thailand.

Patmasiriwat, D., Limskul, K. (1987), Sources of Econmic Growth in Thailand testing of the Present and Revised Series of National Accounts of Thailand, A Research Project Submitted to the National Ecomomic and Social Development Boards (in Thai), Bangkok Thailand 1987.

Office of the National Economic and Social Development Board, The National Income of Thailand, New Series 1988 edition

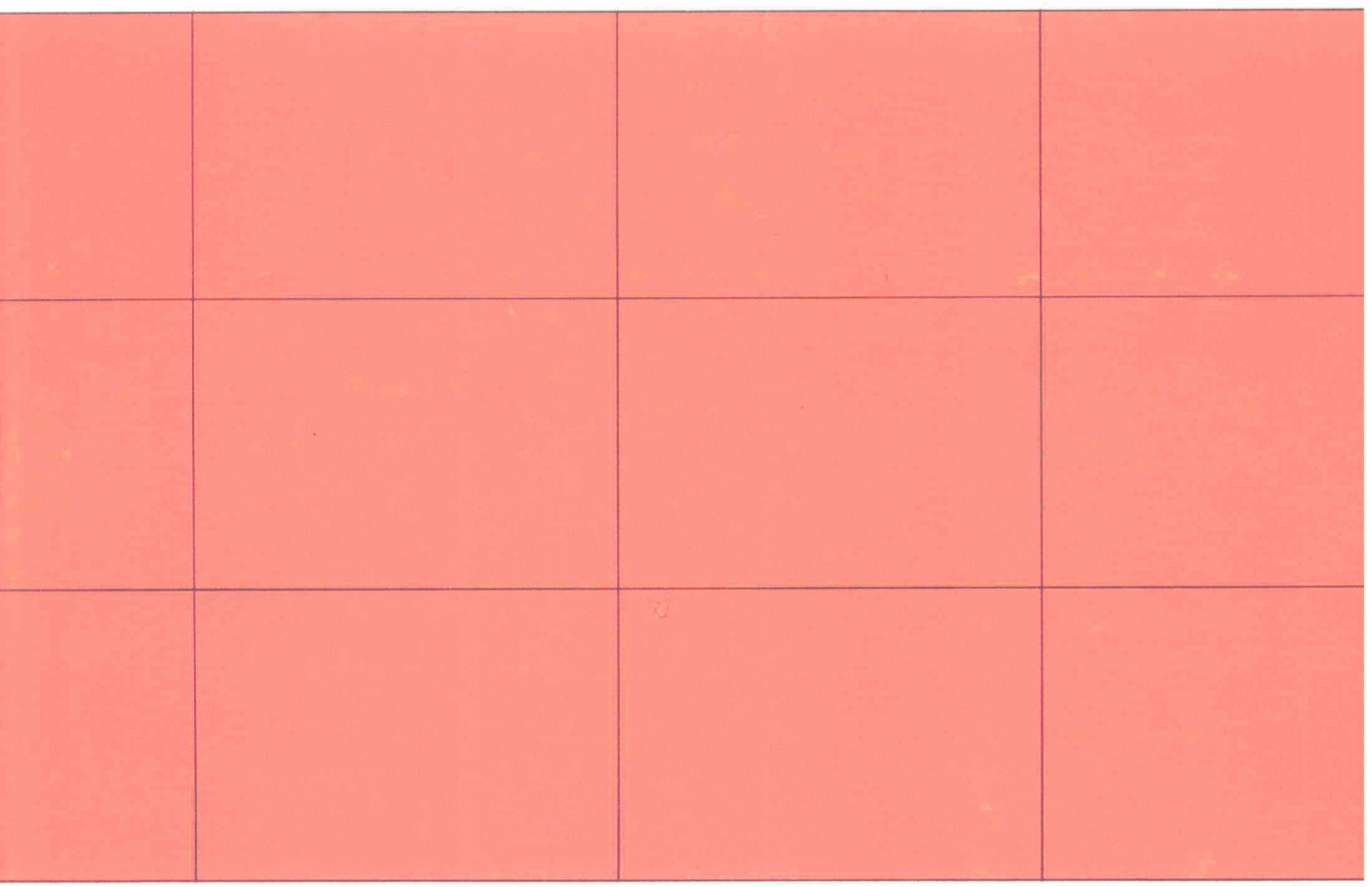
Osada, H. and Hiratsuka, D. (1989), Business Cycles in Five Asean Countries, India and Korea (II) , Institute of Developing Economies, Tokyo, Japan

Statistical Research Department, Institute of Developing Economies (1988), Business Cycles in Five ASEAN Countries, India and Korea, Tokyo, Japan

SGV-ARTHUR ANDERSEN CONSULTANTS LTD. (1988), Flat Glass Market and Location Assessment Study in Southeast Asias: Thailand

Sukhotanang, Damri (1989), "Supporting Industries in Thailand," in Samart Chiasakul et al., Thailand's Economic Development in the 1980's Institute of Developing Economies, Tokyo

Yoshida, Mikimasa (1989), "Development Policies of Basic Industries," in Samart Chiasakul et al., Thailand's Economic Development in the 1980's Institute of Developing Economies, Tokyo



565 Soi Ramkhamhaeng 39 (Thepleela 1), Bangkapi, Bangkok 10310

Tel: (662) 718-5460 extention 216-218; Fax: (662) 718-5461-2;

Email: publications@leela1.tdri.or.th; Web site: http://www.info.tdri.or.th