A Study on Estimation of Potential for Commercial Development in the Central District of the Local City

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Recently, the deteriorated phenomenon of the commercial function is progressing in the central district of the local city. Then in this study, the potential of the commercial development in the future is estimated.

The procedure of this study is the following. Firstly, the commercial condition in this study area is investigated. Secondly, some models to estimate the commercial potential are made up using a sum of sale and an area of commercial floor as the objective variables and the numbers of offices and employees as the explanatory variables. In result, twelve models are obtained for Multiple Rergression Analysis and tested. Finally, using these models, Effective Analysis by new development is practiced.

Consequently, it is expected that the new development brings increase of the commercial potential.

1. Introduction

Since about 1970, the highpermarkets have been made inroad into the local city, and these facilities directly exerted influence on the perpheral traffic and commercial conditions. Recently, they have effected just for urban structure in the local city which has the low rate of urban growth. Particularly, in the case of Fukui City where is our study area, the deteriorated phenomenon of ecnomic in the central district has been progressed by rapid increase of the hypeprmarkets in the outskirts of the city.

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The object of this study is making up some models for estimation of the potential for commercial development in the central district.

Firstly, necessary data are collected and adjusted. Secondly, the models for estimation of potential are made up using Multiple Regression Analysis. Thirdly, the influence by new commercial development are forcasted and evaluated.

The explanatory variables are the numbers of offices and employees on each type of the various industries. The objective variables are an area of the commercial floor and a sum of sale.

The models are found to be significant from the consequence of F-Test. And it is clear that we can expect the tendency of the potential for commercial development by the location of each office using these models.

2. Collection and adjustment of data for analysis

2-1 Definition of the central district

Hokuriku Line and Asuwa River have produced influence of the partition on the central district in Fukui City besides histrical change. In result, the central district exsists on the westside of Hokuriku Line and northside of Asuwa River. The central district is shown Fig.-1, and the sphere coincides with Office Statistics Survey.

As for the change of commercial index which represents the height of commercial function, the increase of the numbers of employees from 1972 to 1983 are 800 persons in Fukui City, but they are only 140 persons in the central districts. Accordingly, the increasing tendency of commercial potential in the central district seems to become more slowly in these days.
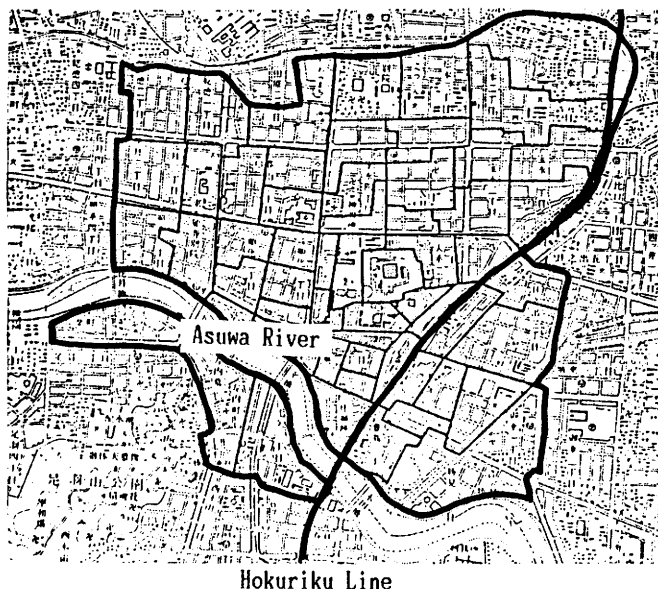
Fig.-1 Central District of Fukui City(Study Area)

note: The district is diveded into 59 zones.

## 2-2 Data collection for potential analysis

(1) Change of numbers of offices and employees

Change of the numbers of offices and employees from 1978 to 1981 is investigated on the principal industries. In term of whole tendency of change, there are differences about the zones and the type of industries. Fig.-2 shows the characteristics of industries.

Firstly, the industrial characteristics of representative zones are as follows:

(a) The center of the city(1 ~15 zone)

There are large increase of the service industy, small increase of the constructive industry and official duties. The wholesale retail business and money insurance business have increase of the numbers of the offices, but have decrease of the numbers of the employees.
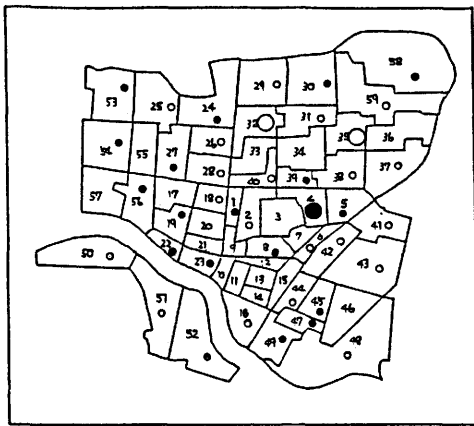
Increase of the Numbers of the Offices (Constructive Industry)
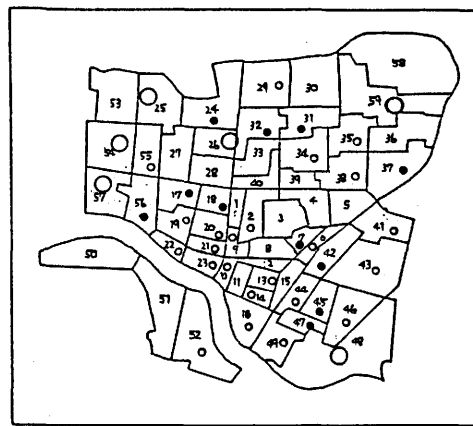
Increase of the Numbers of the Offices (Manufacturing Industry)
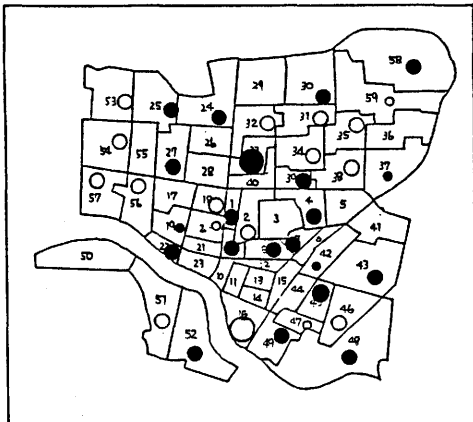
Increase of the Numbers of the Employees (Constructive Industry)
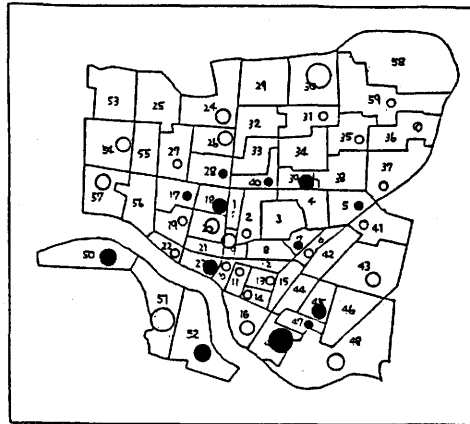
Increase of the Numbers of the Employees (Manufacturing Industry)

Fig.-2(a) Change of Industry

Fig.-2(b) Change of Industry

(b) The eastside of the station(41~49 zone)

There are large increase of constructive industry and service industry. The wholesale retail business have decrease of the numbers of offices, but have decrease of the numbers of employees.

(c) The westsouth side of the river(50~52 zone)

There are increase of the numbers of the offices and decrease of numbers of employees on the wholesale retail business.

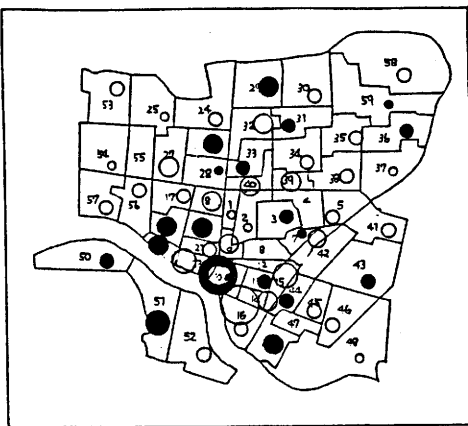(d) The outskirts of the central district(24,25,29,30,53~59 zone)

Though many of industries are decreasing, the service industry is increasing. The numbers of the employees of manifacuturing industry and official duties are decreasing.
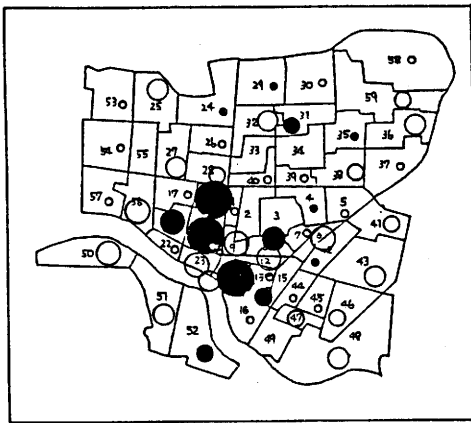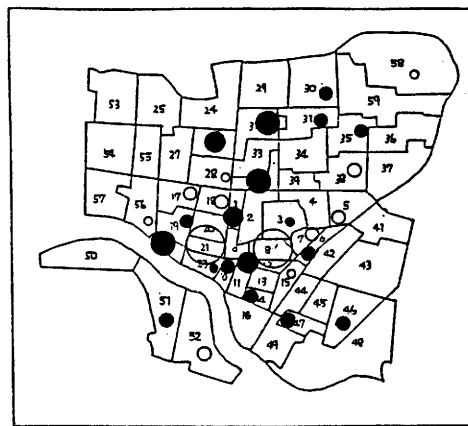

Increase of the Numbers of the Offices (Wholesale, Retail Industry)
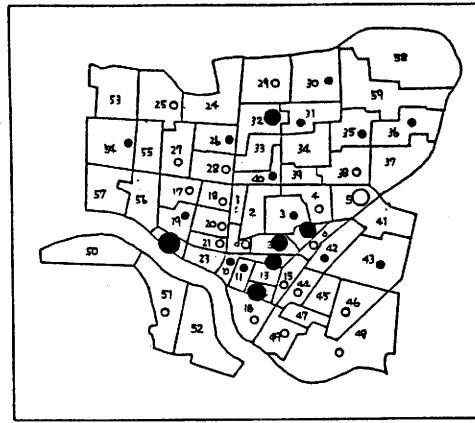
Increase of the Numbers of the Offices (Money Insurance Service)

Increase of the Numbers of the Employees (Wholesale, Retail Industry

Increase of the Numbers of the Employees   (Money, Insurance Service)

Fig.-2(c) Change of Industry

Fig.-2(d) Change of Industry

Secondly, the characterestics on each type of the industries are as follows:

(a) The industries which have the larger change are wholesale retail business and service industry, and both of them show remarkable change of decrease and ncrease.

(b) With respect to manifacturing industry and transportation communication service, they have more decreased zones than increased zones, and both of them show few increase of the numbers of offices and employees.

(c) The money insurance business and real estate business tend to increase around the center of the city.
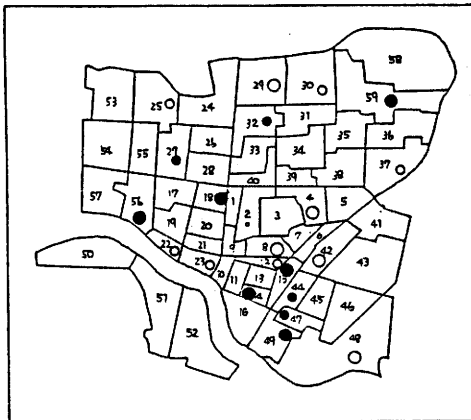
(d) The numbers of employees of the constructive industry are increasing, as compared with increase of the numbers of the offices.
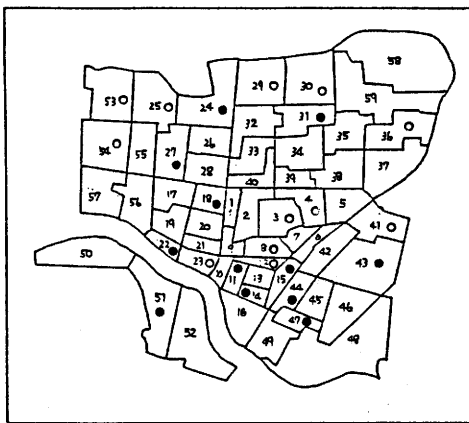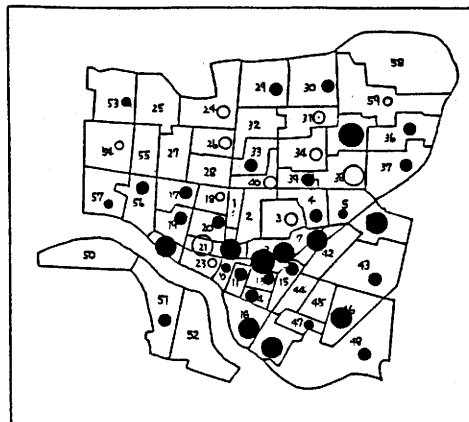

Increase of the Numbers of the Offices (Transportation, Comminucation Service)
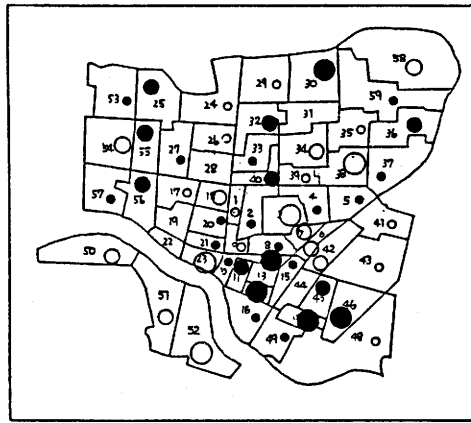
Increase of the Numbers of the Offices (Service Industry)

Increase of the Numbers of the Employees (Transportation, Comminucation Service)

Increase of the Numbers of the Employees (Service Industry)

Fig.-2(e)   Change of Industry   Fig.-2(f)   Change of Industry

(2) Change of an area of the commercial floor and a sum of sale in the central district

An area of the commercial floor and a sum of sale have been increased from 1979 to 1982. But there are increased zones and decreased zones in this study area.

As for increased and decreased zones, distribution of both indices are same significantly.

(a) Change of an area of the commercial floor (Fig.-3)

An area of commercial floor has grown from 1979 to 1982 and the amount is 17, 075m. The numbers of decreased zones are 24 and the numbers of increased zones are 35. The decresed zones concentrate on the westside of the station, and the zone that indicates largest decrease is 12th zone. The increased zones disperse in the whole area, but the zone having larger increase mainly exists on the westside of the station too. Though the numbers of the increased zones are more than the numbers of the decreased zones, quantitative increase is little. Accordingly, increase of an area of commercial floor tends to grow more slowly.
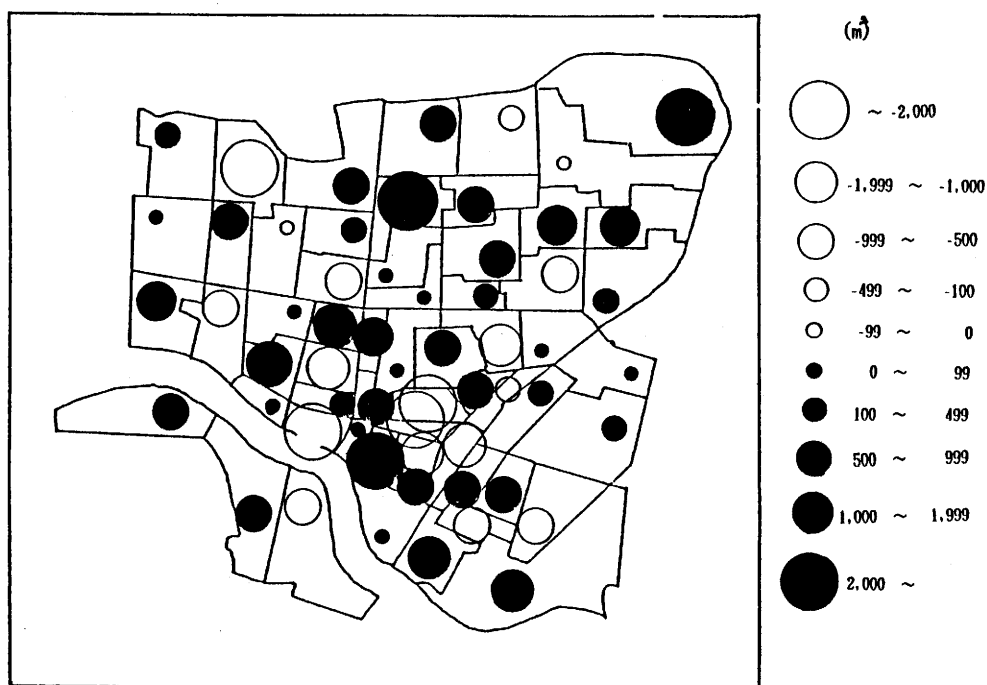

Fig.-3 Change of Commercial Floor

(b) Change of a sum of sale(Fig.-4)

A sum of sale has been grown from 1979 to 1982, and the amount is 11,818
million yen.   Except for 15,400 million yen in 11th zone, the amount becomes
3,600 miliollion yen, and the commercial growth tends to accumulate.   There
are a lot of decreased zones on the westside of the station similar to an area
of the floor.   As above mentioned, the zone has largest increase is 11th zone,
and the other larger increased zones mainly locate in the northside of this study
area.   In particular, a sum of sale is increasing on the outskirts of the central
district.   The numbers of the increased zones are 41 and them of decreased zones
are 18, and the increased zones are overwhelmingly more than decreased zones.

However, the amount of increse is less than the amout of decrease concerning
a sum of sale.   In result, it seems that a sum of sale is deteriorating.

(Ten Thousand Yen)

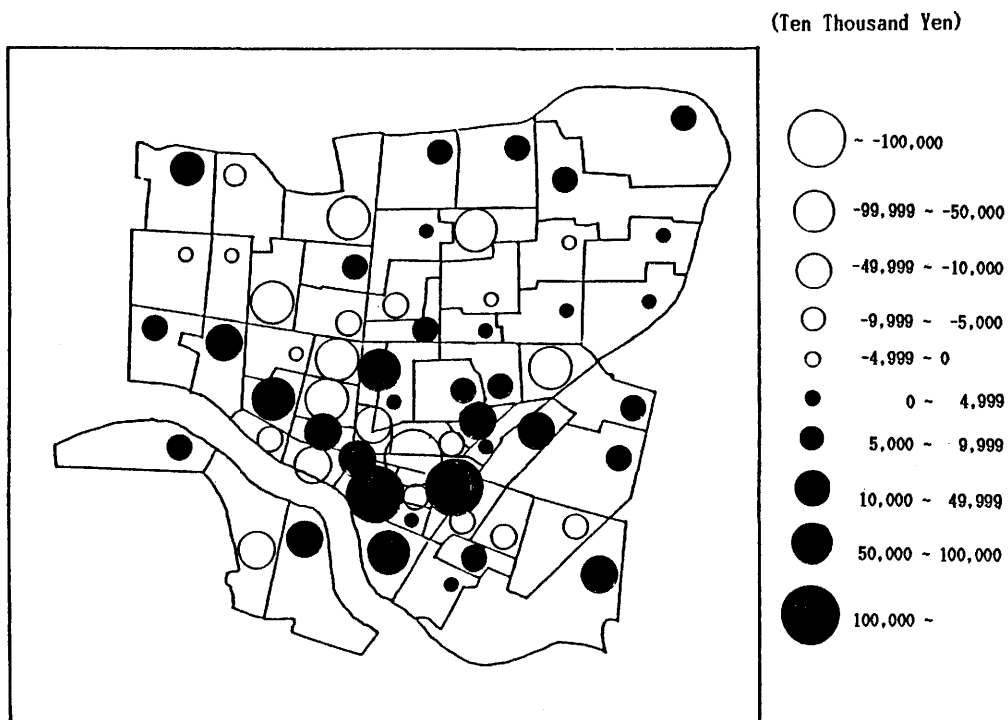|	
○	~ -100,000
○	-99,999 ~ -50,000
○	-49,999 ~ -10,000
○	-9,999 ~ -5,000
○	-4,999 ~ 0
●	0 ~ 4,999
●	5,000 ~ 9,999
●	10,000 ~ 49,999
●	50,000 ~ 100,000
●	100,000 ~

Fig.-4   Change of a Sum of Sale

3. Estimation of the potential for commercial development in the central
district

3-1 Making of the potential model

At above section, we recognized that both of the explanatory and objective
variables have the different values on each zone. Here, the correlation between
them are investigated by Correlation Analysis. And the analysis is practiced for
12 cases. The combinations of explanatory and objective variables are shown in
Table-1. The method of this analysis is Multiple Regression Analysis, and Multi-
collinearity which causes robust correlation between variables is eliminated from
the models.

3-2 The model of potential for commercial development

The models obtained using Multiple Regression Analysis are shown in Table-2.
In result, twelve equations and Standard Partial Correlation Coefficient(BETA)
are obtained, and they are shown in Table- 3. All models are significant with

Table-1 Combination between variables

	78 E	78 0	81 E	81 0	I E	I 0
79 S	case-1	case-2				
79 F	case-3	case-4				
82 S			case-5	case-6		
82 F			case-7	case-8		
I S					case-9	case-10
I F					case-11	case-12

Explanation of sign
78 E = The numbers of employees on each industry(1978)
81 E =   (1981)
78 0 = The numbers of offices on each industry(1978)
81 0 =   (1981)
I E = Increase of the numbers of employees during three years
I 0 = Increase of the numbers of offices during three years
79 S = A sum of sale on each industry(1979)
82 S =   (1982)
79 F = An area of commercial floor on each industry(1979)
82 F =   (1982)
I S = Increase of a sum of sale during three years
I F = Increase of an area of commercial floor during three years

Table-2 Models by Multiple Regression Analysis

Explanatory Variable	Objective Variable				Explanatory Variable	HH	MM
	H54	M54	H57	M57			
A O 53, 56					A A O		●
D O 53, 56					D D O		
E O 53, 56					E E O	●	●
F O 53, 56	●		●		F F O		
G O 53, 56	○	○	○	○	G G O	○	○
H O 53, 56					H H O		
I O 53, 56					I I O	●	
J O 53, 56	○		○	○	J J O	○	
K O 53, 56					K K O	●	
L O 53, 56					L L O	●	●
M O 53, 56					M M O		
A E 53, 56		●			A A E		
D E 53, 56	●				D D E		
E E 53, 56					E E E		
F E 53, 56	●			○	F F E	○	○
G E 53, 56	○	○	○	○	G G E	○	○
H E 53, 56					H H E		
I E 53, 56	○				I I E		
J E 53, 56	○				J J E	○	
K E 53, 56					K K E		
L E 53, 56					L L E	○	
M E 53, 56					M M E		

NOTE; Partial Correlation Coefficient ○(possitive) ●(negative)

Explanation of sign

A,O,E 53,56　(A=agricultural industry,O=the numbers of offices,E=the numbers of
　　　　　　　employees,53=1978,56=1981)
D,O,E 53,56　(D=mining industry,　　　　　　　〃　　　　　　　　　　　　)
E,O,E 53,56　(E=constructive industry,　　　　　〃　　　　　　　　　　　)
F,O,E 53,56　(F=manufacturing industry,　　　　　〃　　　　　　　　　　　)
G,O,E 53,56　(G=wholesale,retail business,　　　〃　　　　　　　　　　　)
H,O,E 53,56　(H=money,insurance service,　　　　〃　　　　　　　　　　　)
I,O,E 53,56　(I=real estate business,　　　　　〃　　　　　　　　　　　)
J,O,E 53,56　(J=transportation,communiocation service　　〃　　　　　　　　)
K,O,E 53,56　(K=electric,gas,water service,　　　　　〃　　　　　　　　)
L,O,E 53,56　(L=service industry,　　　　　　　　〃　　　　　　　　　)
M,O,E 53,56　(M=official duties,　　　　　　　　　〃　　　　　　　　　)

H 54,57　(H=a sum of sale,54=1979,57=1982)
M 54,57　(M=an area of commercial floor,54=1979,57=1982)

AAO ～ MMO = increase of the numbers of offices on each industry

AAE ～ MME = increase of the numbers of employees on each industry

HH = increase of a sum of sale

MM = increase of an area of commercial floor

Table-3 Regression Models

DEPENDENT VARIABLE	VARIABLE	B	BETA	MULTIPLE R F
H54	GO53	2393.896	0.55217	0.67952
	JO53	31251.68	0.30132	
	FO53	-6360.353	-0.20358	15.72765
	(CONSTANT)	-21472.59		
M54	GO53	36.89605	0.61575	0.64133
	(CONSTANT)	-214.9498		34.80886
H54	GE53	570.6067	0.71336	0.83881
	JE53	204.2519	0.18882	
	IE53	2337.900	0.12957	25.16266
	FE53	-115.5098	-0.06615	
	DE53	-2702.224	-0.05313	
	(CONSTANT)	-59836.41		
M54	GE53	7.727684	0.69900	0.70495
	AE53	-23.59995	-0.09398	
	(CONSTANT)	-114.9243		27.66030
H57	GO56	2101.548	0.37537	0.46090
	FO56	-7865.796	-0.16995	
	JO56	20032.30	0.14073	4.94501
	(CONSTANT)	69052.45		
M57	GO56	31.49468	0.30688	0.33753
	JO56	232.2959	0.08903	
	(CONSTANT)	542.2158		3.60006
H57	GE56	676.4598	0.62723	0.64374
	FE56	466.6980	0.19541	19.81404
	(CONSTANT)	-62858.28		
M57	GE56	9.848376	0.49815	0.67368
	FE56	21.44559	0.48984	23.26689
	(CONSTANT)	-1712.794		
HH	GGO	12162.67	0.50859	0.56697
	LLO	-9046.276	-0.15429	
	JJO	41713.38	0.14259	4.10577
	IIO	-16115.17	-0.12107	
	EEO	-12628.63	-0.09315	
	KKO	-54010.51	-0.06939	
	(CONSTANT)	54494.17		
MM	GGO	146.3725	0.33884	0.40298
	LLO	-294.1686	-0.27774	
	AAO	-130.2466	-0.07982	2.61729
	EEO	-176.3624	-0.07201	
	(CONSTANT)	910.5024		
HH	GGE	1625.903	0.72606	0.74258
	JJE	2925.321	0.15785	
	FFE	919.6605	0.13417	16.59560
	LLE	578.2248	0.09060	
	(CONSTANT)	43190.70		
MM	GGE	17.33013	0.42842	0.50071
	FFE	34.41521	0.27794	9.02438
	(CONSTANT)	907.2712		

α=0.05. Explanatory variables with reference to wholesale retail business adopted in all models and the variables of transportation communication service are used in many models. The Partial Correlation Coefficient of explanatory variables of constructive industry and service industry are negative in all equations. Multiple Regression Coefficient and F-Value with respect to the equation that has a sum of sale as an objective variable in 1979 is highest within twelve models. The former(R) is 0.84, and the latter(F) is 25.16.

3-3 Effective Analysis by new commercial development

In this section, it is examined the effect that new development produces on one zone using the result obtained before. Then the first zone which has a plan of new development is selected as an objective zone.

Effective Analysis by new development is practiced for twelve models obtained before. Quantity of development in the future (explanatory variables) in the first zone is shown in Table- 4.

Table-4 Plan of New Development

	The Numbers of Offices	The Numbers of Employees
Retail Wholesale Business	40	100
Money Insurance service	15	150
Real Estate Business	5	100
Service Industry	30	500

Table-5 Result of Calculation

	Residual	Calculated Value	Estimated Value
Case 1	103,290	391,265	287,975
Case 2	1,135	3,069	1,934
Case 3	10,845	336,246	325,402
Case 4	764	1,995	1,231
Case 5	131,784	266,249	134,465
Case 6	1,818	3,715	1,897
Case 7	3,229	121,280	118,051
Case 8	-522	1,100	1,622
Case 9	30,887	183,175	202,692
Case10	83	-1,793	-1,239
Case11	9,508	475,653	516,550
Case12	-275	2,553	3,465

In Effective Analysis, Residuals of each model are calculated, and estimated value are obtained from adding Residuals to calculated value by model equations. The results of calculation are shown in Table-5.

It is suggested from the result of the above calculation that the highest value of a sum of sale in the first zone is 5165 million yen(HH model) , and the highest value of an area of commercial floor is 3465m(MM model) in the future when a plan of new development will be carried out.

4. Conclusion

The purpose of this study is making up the models for estimating commercial potential in the central district of the local city. Objective variables are a sum of sale and an area of commercial floor, and explanatory variables are the numbers of offices and employees. Twelve models are made up and tested.

Estimated value of commercial potential (objective variables) are calculated when the new development is carried out in the first zone using these models. In result, it is expected that new development brings increase of commecial potential. We thank to Mr. Isao Funakawa for his assistance on this study.

References

1) Mutsuo Tominaga, Yoshiaki Honda; On Characteristics of the Commercial District in the Local City; City Planning Review, No.18(1983)

2) Mutsuo Tominaga, Yoshiaki Honda, Masamitsu Mori; On Relationship between Urban Structure and Commercial Development; Urban Planning 114 (1981)