ESTIMATING A FUNCTION FOR THE GROSS REVENU OF A SAMPLE OF FRENCH TRAWLERS

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THE GROSS REVENU OF FRENCH TRAWLERS

Introduction

The purpose of this paper is to test the equation that allows gross income to fit age and length of french high sea trawlers :
log (gross income) = a log (length) + b (age) + c

Others attempts have been performed to replace length by the engine power, in order to see if it improves the results or not.

Description of the sample

The analysis was performed on a sample of 98 high sea trawlers, fishing in the North Sea and in the Atlantic Ocean (Ireland Sea, West and North Scotland). These boats are coming from two majors areas in France :

- 18 are coming from the Northern Region (17 are originating from the port of BOULOGNE, 1 from FECAMP) ;

- 80 are coming from South Brittany, distributed among CONCARNEAU (34), LORIENT-ETEL (37) and DOUARNENEZ (9).

Roughly speaking, the two groups are fishing in different areas. Boulogne trawlers are mainly fishing in the North Sea (IVa) (1) while ships from South Brittany are most often fishing in zones VI, VII and IVa (West of the British Isles).

General statistics on the sample are shown in table 1, including the mean, standard error and range on the gross revenu (individual vessel data were requested from 17 ship-owners).

Table 1 : Sample statistics on data series

	OBS	MEAN	STD ERROR	MINIMUM	MAXIMUM	STAN. DEV.OF MEAN
GROSS INC	98	10.478	5444.1	2185	25000	549.93
POW	98	118.99	57.559	40	212	8.284
GRT	98	349.52	196.31	100	757	19.83
LENG	98	39.776	10.629	22	59	1.073
AGE	98	12.806	6.0830	1	24	0.614

(1) ICS areas

where GROSS INC is the yearly gross revenu per boat ('000 FF) in 1985
POW is the main engine power (10 HP)
GRT is the gross tonnage of boats (GRT)
LENG is the length of boats (meters)
AGE is the age of boats in 1986 (to avoid aging boats built in 1985 as zero year old boats)

Figures in appendix describe the various parameters of this sample. Among these 98 trawlers appear three main categories :

the oldest boats (more than 16 years old) are usually less than 35 meters long and, broadly, they are limited to less than 1000 HP (figure 1,2,3). A second group gathers the trawlers measuring more than 50 meters long. They are all middle aged boats (10 to 16 years old) and they present a wide range of engine power. Finally, the third group looks quite heterogenous : the youngest boats (1 to 5 years old) having their mean around 34 meters long but show an important standard deviation.

In figure 4, the gross revenu is plotted against the year of construction. The gross revenu is roughly decreasing with the age for boats built between 1962 and 1974 (this is probably related with the increasing sizes of the boats on this period). The level of the gross revenu of boats built from 1981 to 1985 is about the same as for the oldest boats.

Testing the equation

Although the first proposition was to test the equation using the logarithm of the length of the boats and the age as exagenous variables, we also test two supplementary hypothesis :

- we try to replace length by the main engine power, as we were dealing with trawlers whose fishing capacity can be, supposedly, related to the engine power. It has not been possible to use both these variables because of correlation problems (see the matrix of correlation, table 2). As the gross tonnage of boats is closely related to their length (figure 5), we found useless to test the equation both with length and gross tonnage ;

- a second idea was to introduce a dummy variable figuring the port of origin, as the two groups are fishing on different fishing grounds. We choose, arbitrarily, to represent the port of Boulogne with the dummy.

Table 2 : Correlation matrix

	GRT	LENG	POW	AGE
GRT	1	0.9809	0.96280	0.12919
LENG		1	0.96349	0.12265
POW			1	0.21195
AGE				1

The results are consistent with the assumptions one can make on the relationships between gross revenu and vessels characteristics (observed and fitted values are plotted in figures 6 and 7) (1) :

1 - in each case, a negative elasticity is found between age and gross income ; it can be explained in assuming that old boats are relatively less efficient than the new ones. Although significant, the coefficent is low ;

2 - gross income is positively related with boats length or engine power. Coefficients are always significant ;

3 - introducing the dummy variable does not much improve the results ; no strong modifications in the value of the coefficients were observed. The negative signs of the coefficients are probably linked with the crisis the Boulogne fleet is presently going through (Boulogne fleet, in the sample, is mainly represented by large trawlers of more than 50 meters long). Nevertheless, the coefficients of the dummy variable are not much significant and this call for much carefulness in using and/or interpreting the results ;

4 - at a 5 % level of significance, using the Durbin-Watson test, the hypothesis of no autoregression has to be rejected in every case. This autoregression of disturbance may simply reflect the presence of some unexplained systematic influence on the dependent variable (stock abundance for instance, competition between french and foreign fleet on the same stocks, etc... : these problems need probably to be adress for further modelling).

Table 3 : Regression analysis results

DW(*)	R2	CONSTANT	AGE	LOG(LENGTH)	LOG (CV)	BOULOGNE
1.322	0.890	2.792698 (0.254043)	-0.01678776 (0.002894)	1.794269 (0.0674307)		
1.433	0.899	4.599478 (0.1791701)	-0.006149595 (0.002855)		0.9877645 (0.0354952)	
1.449	0.891	2.601837 (0.3044341)	-0.01691518 (0.00289246)	1.85021 (0.0834712)		-0.063345 (0.0558677)
1.541	0.899	4.483412 (0.2108847)	-0.0059792 (0.00285873)		1.014390 (0.0437184)	-0.0556844 (0.0534239)

(*) Value of Durbin-Watson test : the values in parentheses are the standard error terms related with the correlation coefficiencs above. Dependant variables is log (CHIFDAFF) in all cases. BOULOGNE is the dummy variable associated with the boats coming from the district of Boulogne.

(1) A Large Memory Version of "RATS" (VAR Econometric, INC production) has been used for the regressions

HIGH-SEA TRAWLERS, UAPF MEMBERS*

Home Port	Number of Boats		Gross Registered Tons	
	31.12.83	31.12.85	31.12.83	31.12.85
BOULOGNE	32	22	15 300	12 400
CONCARNEAU	40	34	8 400	7 400
DOUARNENEZ	11	9	3 000	2 700
ETEL	35	30	6 600	5 400
DIEPPE-FECAMP	3	5	1 900	3 100
LA ROCHELLE	9	5	1 900	1 200
LORIENT	22	23	12 600	13 200

Boat length

BOULOGNE	43 to 59 m
CONCARNEAU	27 to 34 m
DOUARNENEZ	32 to 38 m
ETEL	22 to 35 m
DIEPPE-FECAMP	49 to 58 m
LA ROCHELLE	30 to 41 m
LORIENT	33 to 59 m

* (Association of french fishing ship owners)

CHANGES IN THE FLEET BETWEEN 1983 AND 1985

	IN	OUT
BOULOGNE	0	10
CONCARNEAU	2	8
DOUARNENEZ	1	3
ETEL	0	5
DIEPPE-FECAMP	3*	1
LA ROCHELLE	1	5
LORIENT	1*	0

* 1 second hand

Figure 1

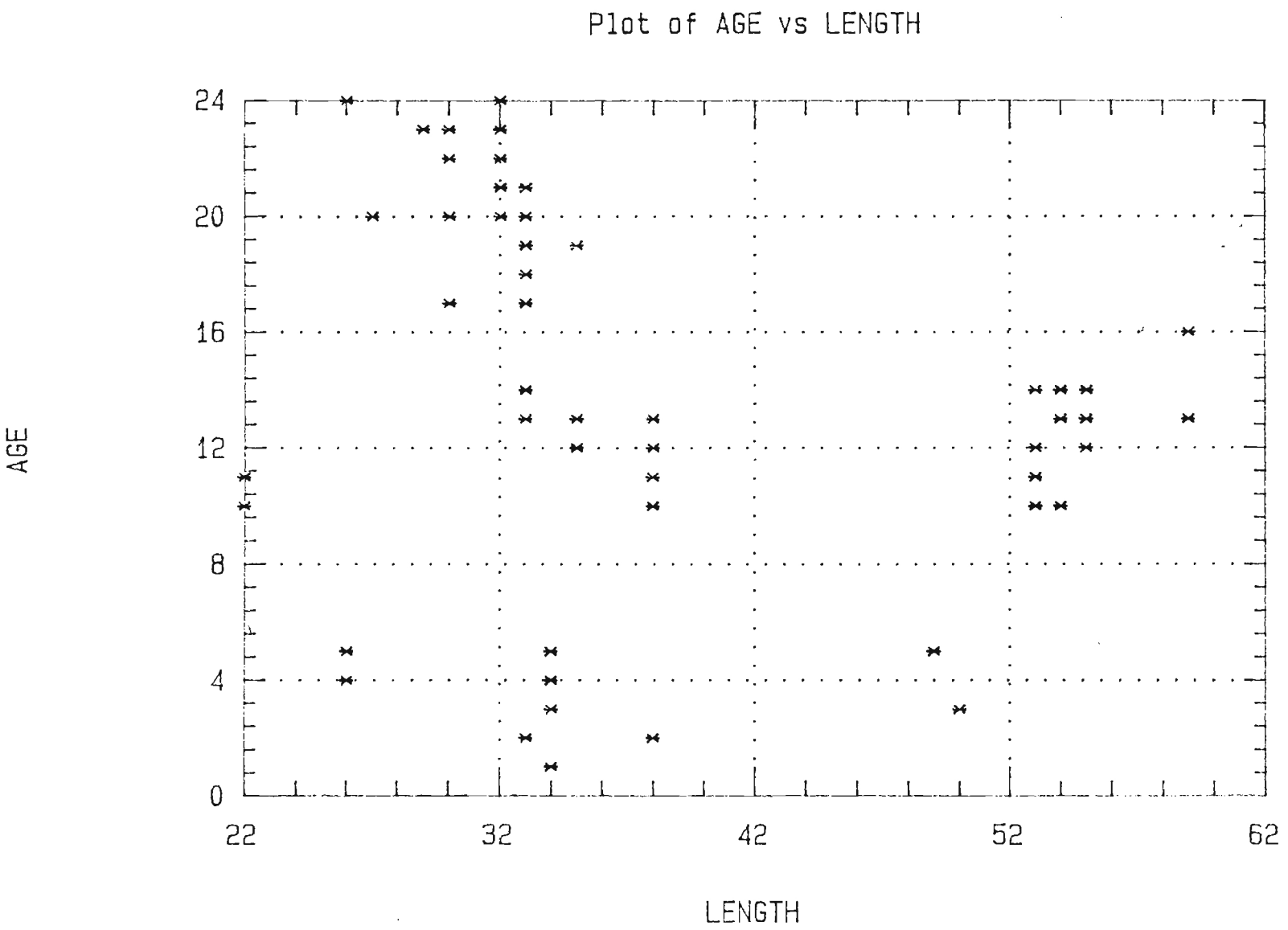


Figure 2

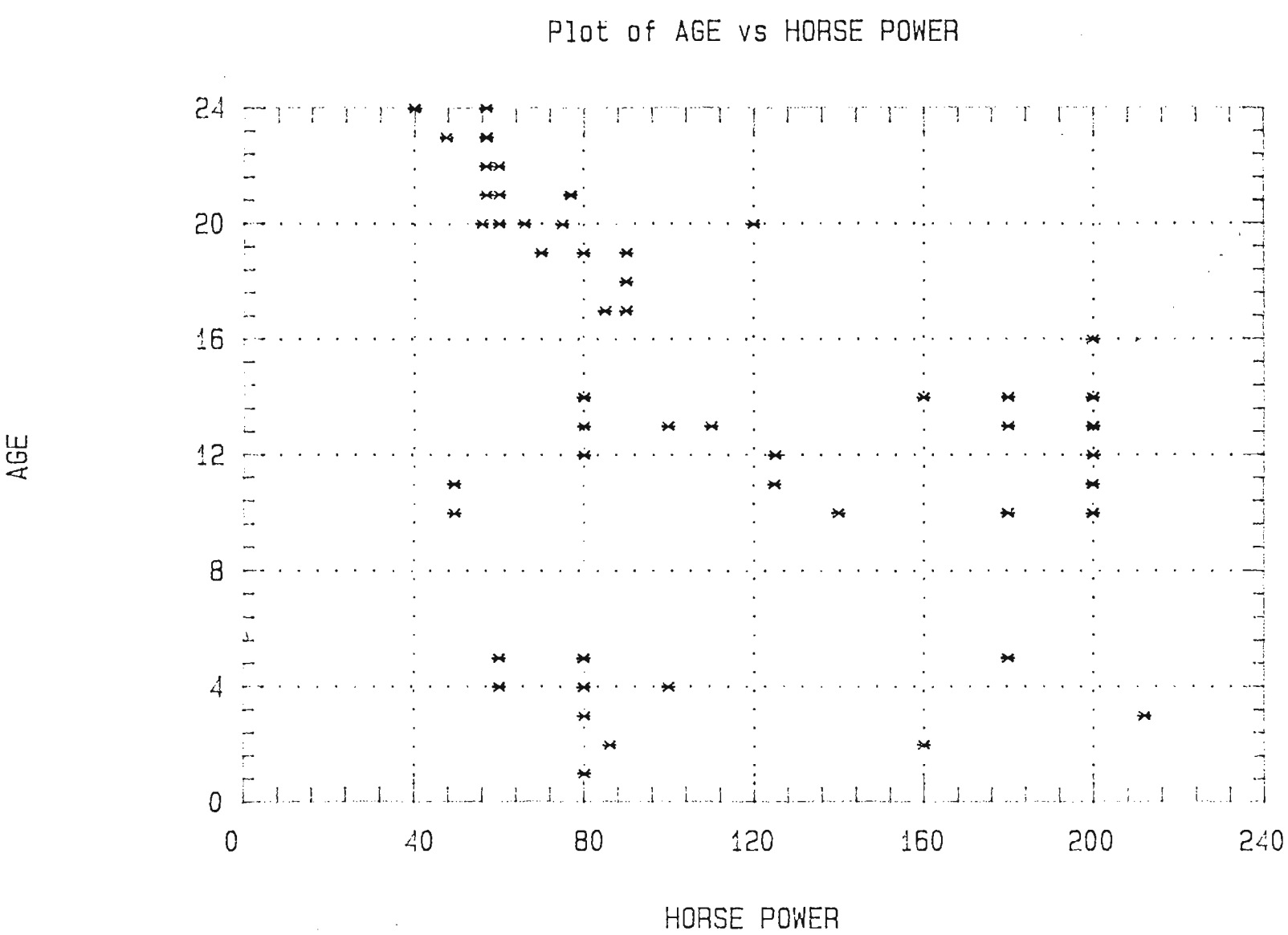

Plot of AGE vs HORSE POWER
AGE
24
20
16
12
8
4
0
0
40
80
120
160
200
240
HORSE POWER

Figure 3

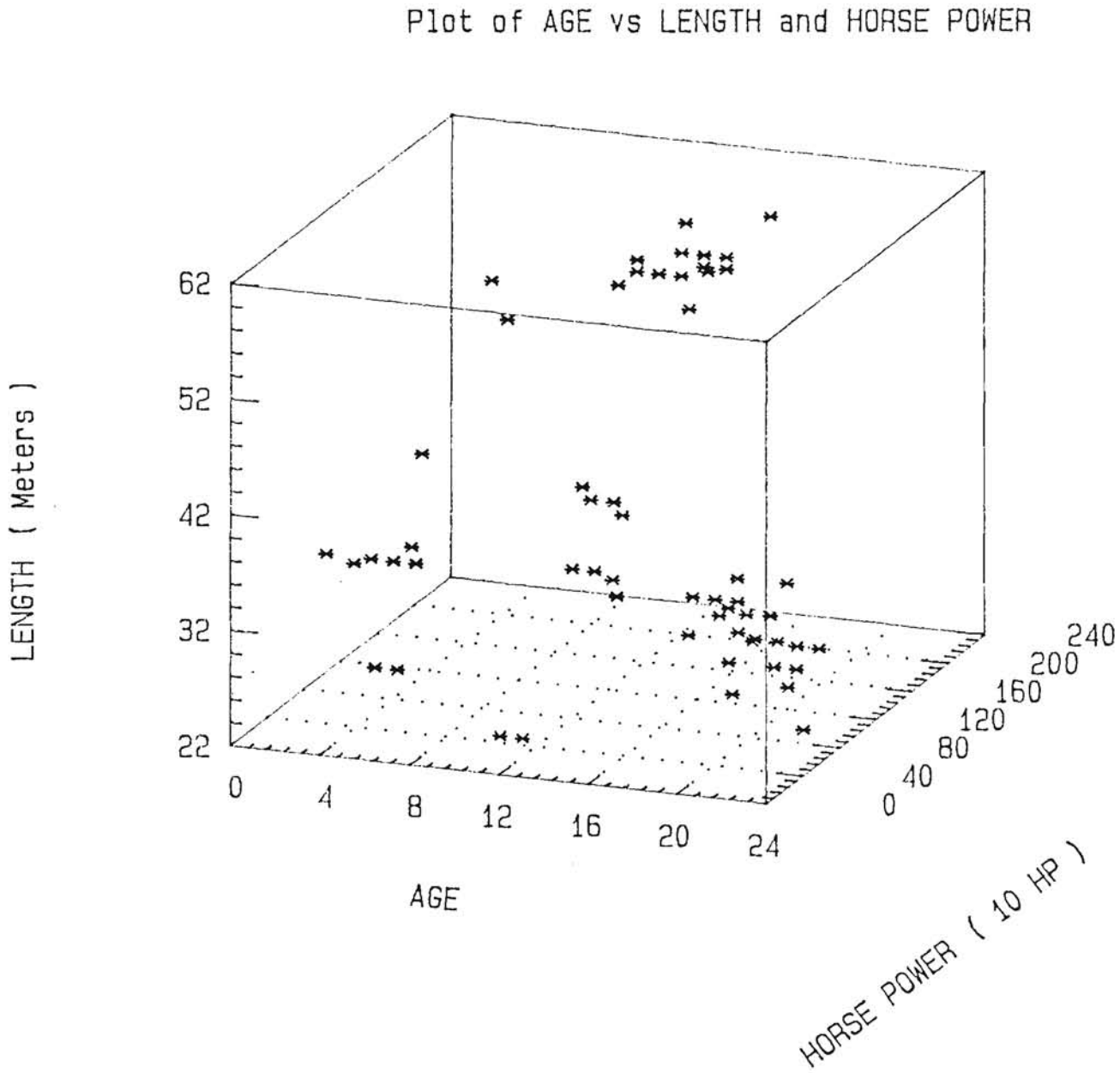

Plot of AGE vs LENGTH and HORSE POWER
LENGTH (Meters)
62
52
42
32
22
0
4
8
12
16
20
24
AGE
0
40
80
120
160
200
240
HORSE POWER (10 HP)

Figure 4

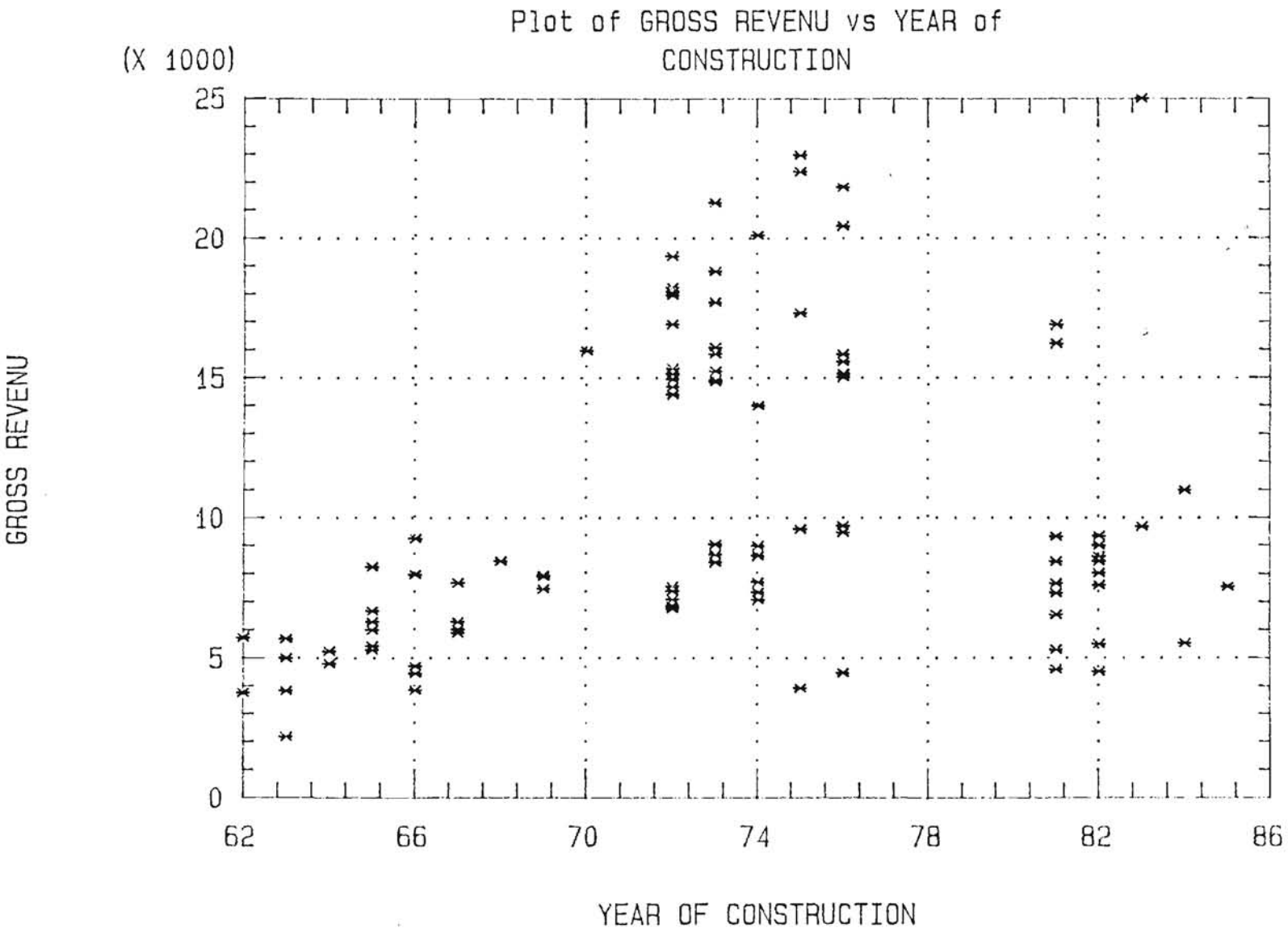
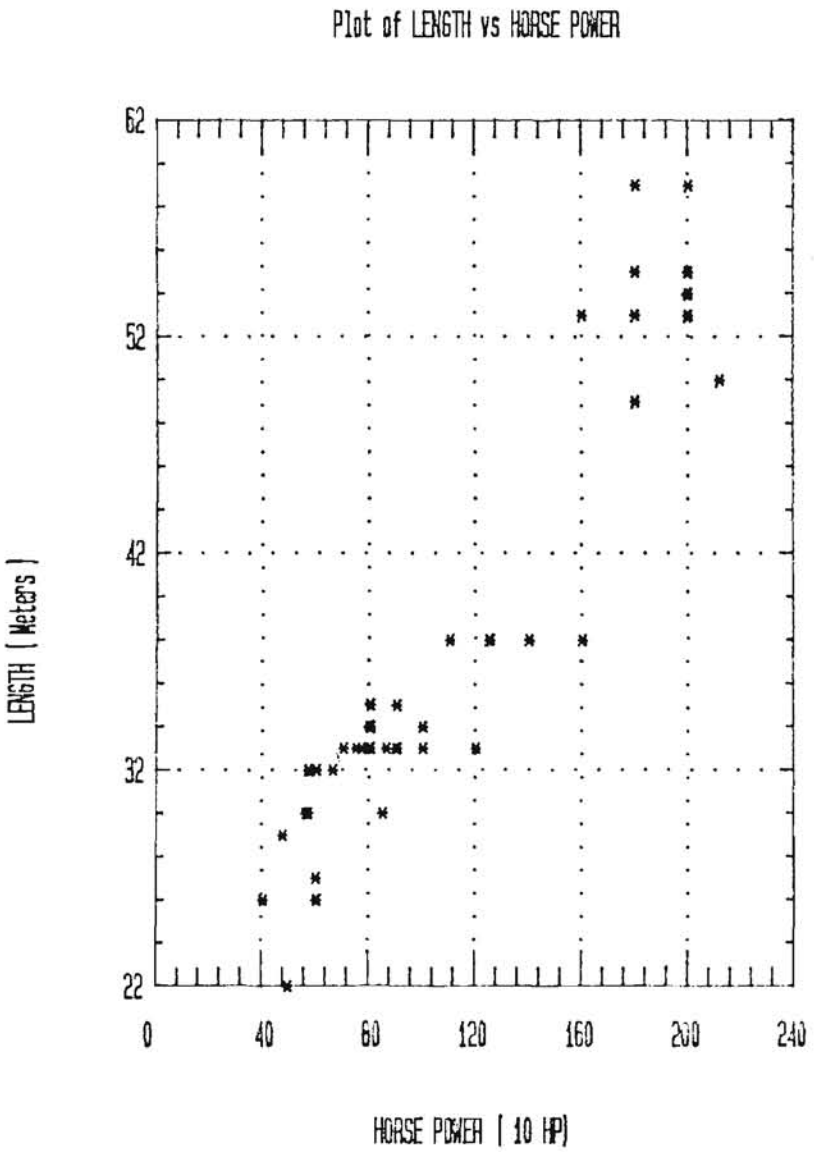

Plot of GROSS REVENU vs YEAR of CONSTRUCTION
(X 1000)
GROSS REVENU
25
20
15
10
5
0
62
66
70
74
78
82
86
YEAR OF CONSTRUCTION

Figure 5


Plot of LENGTH vs HORSE POWER
LENGTH (Meters)
62
52
42
32
22
0
40
60
120
160
200
240
HORSE POWER (10 HP)

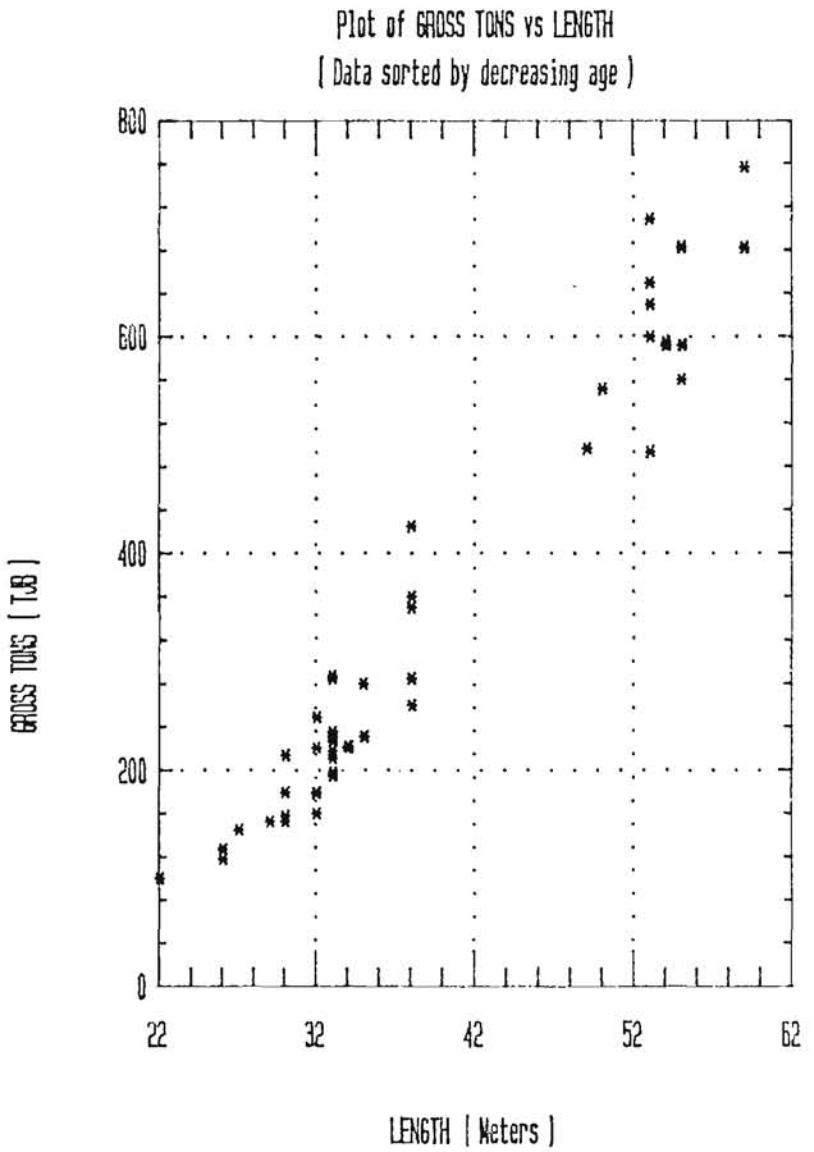

Plot of GROSS TONS vs LENGTH
(Data sorted by decreasing age)
GROSS TONS (TUB)
800
600
400
200
0
22
32
42
52
62
LENGTH (Meters)

Figure 6 : Log (Gross revenu) = f (Constant, age, log (CV))

R^2 = 0,899

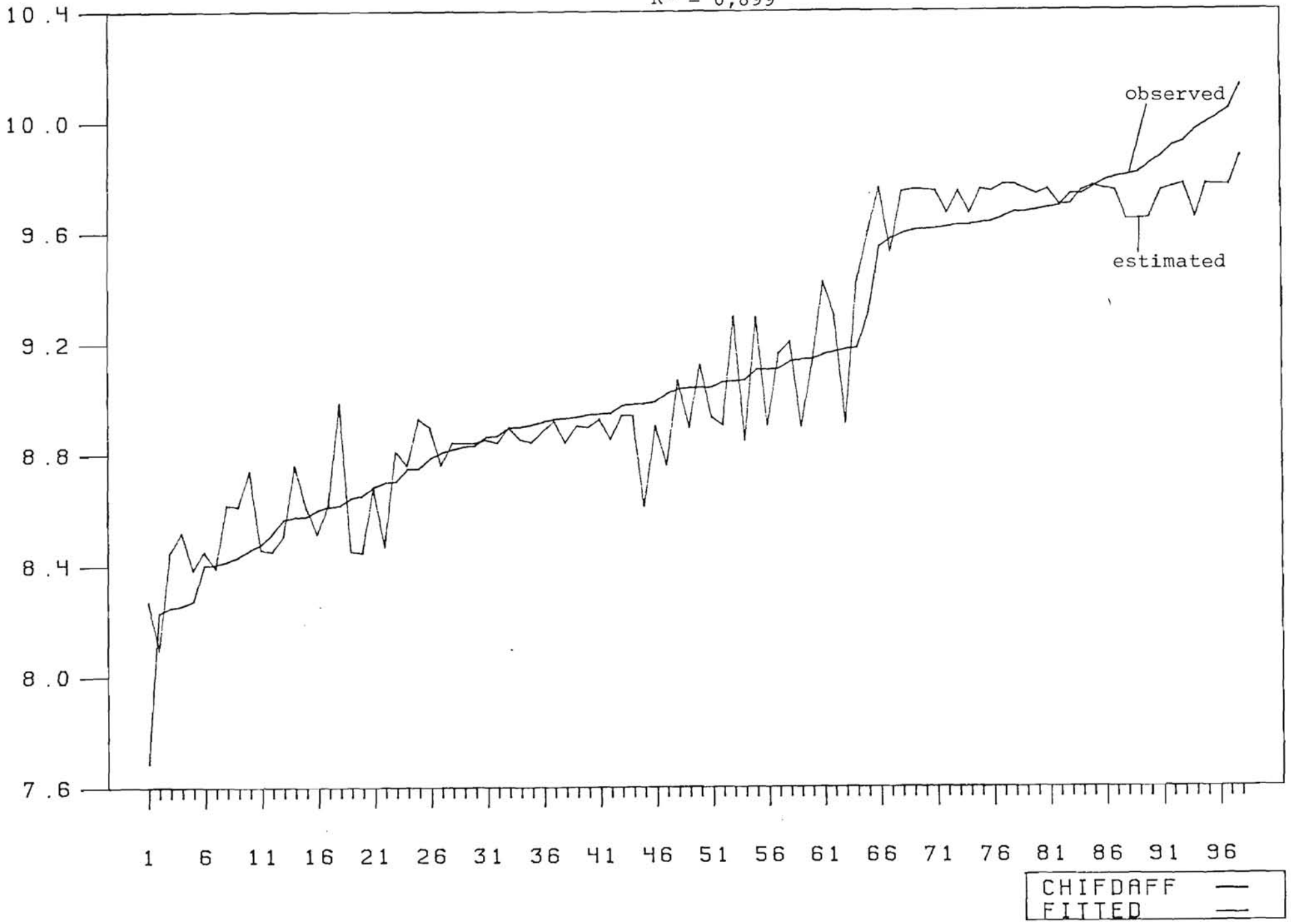


Figure 7 : Log (Gross revenu) = f (Constant, age, log (length))

R2 = 0890

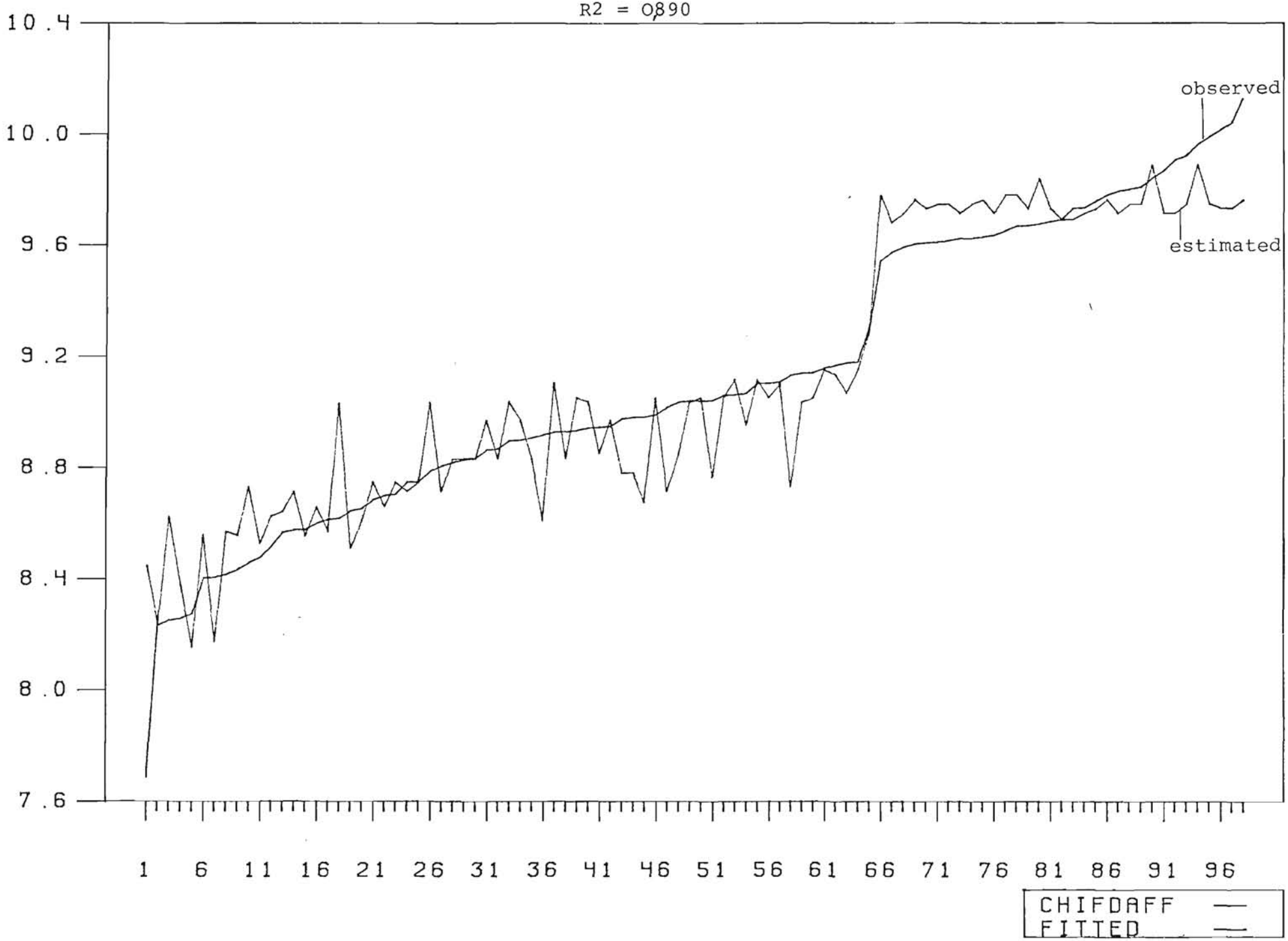


Figure 8 : Gross revenu = f (age, CV)

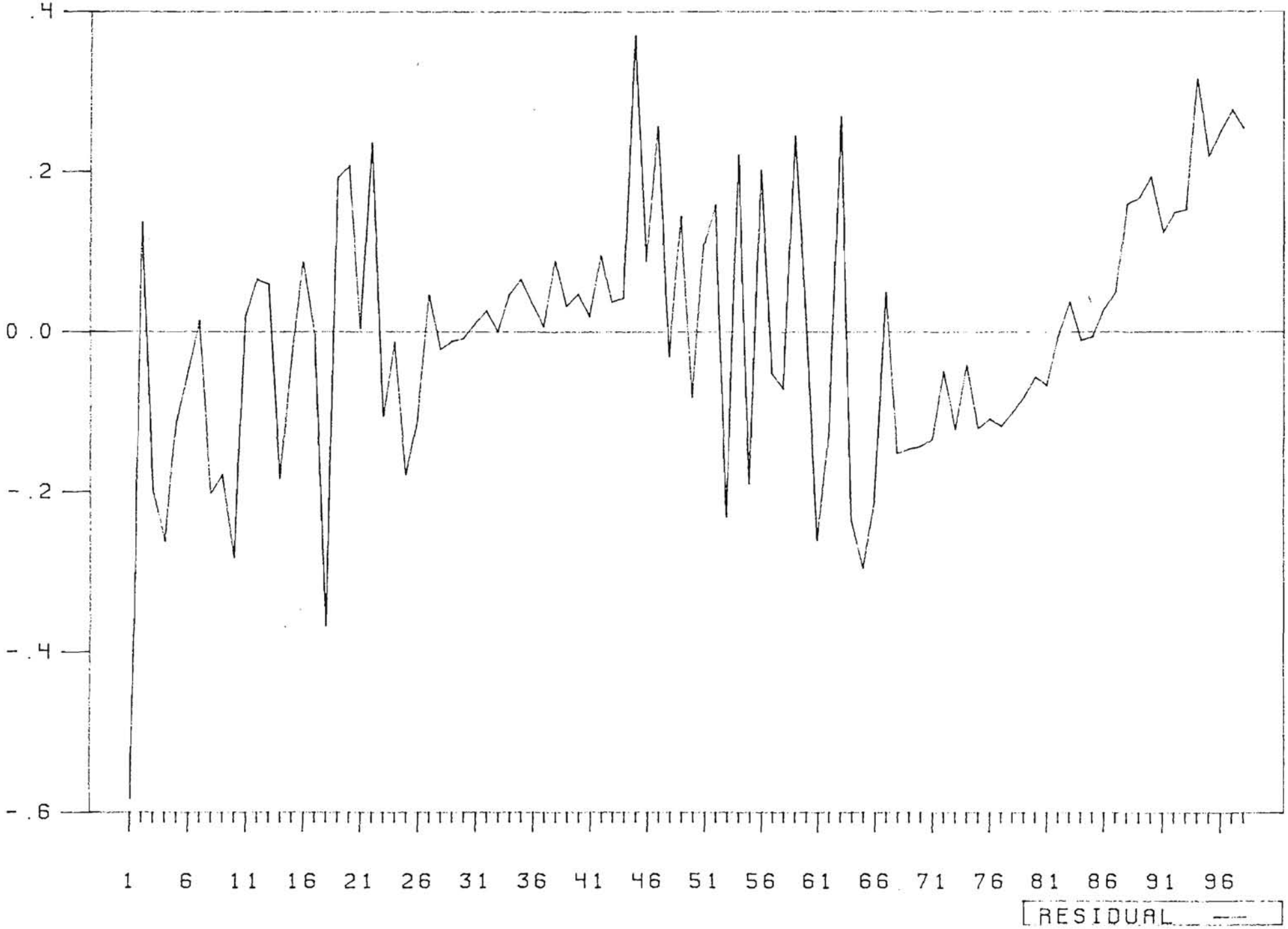


Figure 9 : Gross revenu = f (age, length)