THE IMPACT OF REGULATION ON THE EFFICIENCY OF SWISS REGIONAL BUS COMPANIES

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1. INTRODUCTION

In 1988 the regional bus industry in Switzerland received subsidies amounting to approximately 84 million Swiss Francs or about half a million Swiss Francs per company. The aim of this study is to analyse the inefficiencies in operation which are responsable for this situation and to discuss the role played by the regulatory regime.

The Swiss bus industry contains 177 companies. These are either mixed enterprises or state (i.e. PTT) owned. The operational deficit of the latter enters the general budget of the PTT. The former operate with a monopoly licence for their region and are subsidised in various forms (see below). The PTT bus operations are not considered in this paper. Throughout the rest of this paper the mixed companies will be referred to as "regional bus companies".

Public transport in Switzerland on an intercity level (including transport along the valleys in the Alps) is provided by the railways while urban transport in the agglomerations is supplied by urban transport companies operating trams and buses. Therefore, the regional bus companies studied in this paper serve as feeders into this intercity and urban transport system. In most cases the bus companies operate in rural areas, in some they supply public transport services in smaller towns. The main function of these companies is to link a (rural) region to an urban transport network or to the intercity railway line. This complementary function of the bus companies is a consequence of the regulation protecting the railways. In Switzerland, intercity bus transport is only allowed if not competing with an existing railway line.

The arguments in this study are based on an estimation of a translog cost function for 62 bus companies for which data is available (for the application of a similar specification to the Swiss Private Railways see Filippini 1991, Filippini and Maggi 1992). The specification allows for the distinction of economies of density and scale.[1] Moreover, a frontier cost function is estimated. This allows for the analysis of two different efficiency concepts, namely scale efficiency and cost efficiency. Based upon the findings concerning these different types of (in-) efficiency the policy implications in terms of mergers and changes in regulations can be discussed.

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[1] Note that the conception of scale economies and density economies derived from a cost function do only coincide with the concepts of returns to scale and returns to density in a production function context in the case of a homothetic cost function (see Hanoch 1976).

In Section 2, a translog cost function including the network effects is estimated for the bus companies. The efficiency issue is treated in more detail in Section 3, where the results on scale efficiency are discussed and a DOLS estimation of the cost frontier is used to measure cost efficiency. In section 4 the findings on efficiency are discussed in the context of the Swiss institutional setting. Section 5 presents the conclusions.

2 A TRANSLOG COST FUNCTION FOR THE SWISS REGIONAL BUS COMPANIES

2.1 The cost function

Cost structure and production functions in public transport are well documented in empirical research (see e.g.Caves, Christensen and Swanson 1980, Gathon and Perelman 1987, Berechman 1987, Windle 1988, Thiry and Lawarree 1988, Gathon 1989). A major development in this area has been the distinction between economies of scale and economies of density, introduced by Caves, Christensen, Tretheway and Windle in 1985. Because transport firms are operating different networks, an analysis of their cost structure must take account of the fact that the same output can be produced on differently shaped networks and that different outputs can be produced on the same network. In the latter case, economies of density reflect the relationship between cost and output with the network held fixed. These are to be distinguished from economies of scale which reflect the cost impact of a simultaneous change of output and network size.

Given a production function defined on a vector of inputs **I**, a vector of outputs **Y** and a vector of (technological) shift factors T,

$$f(\mathbf{Y}, \mathbf{I}, \mathbf{T}) = 0 \qquad (1)$$

the properties of the production technology can be inferred from the dual cost function if the production function is strictly convex in the input structure (McFadden, 1978).

$$C = c(\mathbf{Y}, \mathbf{P}, \mathbf{T}) \qquad (2)$$

In (2) **P** is a vector of input prices. The cost function (2) is homogenous of degree 1, non-decreasing and concave in the factor prices. As costs are expected to vary not only with the output size but also with the size and structure of the network, additional variables have to be included in equation (2).

Consider a bus company with three inputs, labour (L), capital (K) and energy (E) which produces a single output Q on a network of size N. Network size can be defined by the lenght of the routes on the itinerary, the number of stops etc..

If it is assumed that the company minimizes cost and that the isoquants are convex, a total cost function can be written as:

$$TC = f(Y, N, P_L, P_E, P_K, T) \qquad (3)$$

In this study, output Y is measured in passenger kilometers and, alternatively, in seat kilometers. P_L, P_E and P_K stand for the prices of labour, energy and capital, respectively. The shift variable T is a time index, indicating among else the level of technology. Technical change is therefore viewed as a time related shift of the cost function the parameter of which measures the constant annual rate of neutral technical change in the estimations presented below (for this approach see e.g. Glass and McKillop 1989). Introducing an indicator of the network size in the cost function together with output is equivalent to treating this variable as output characteristic. (3) therefore represents a hedonic cost function (see Panzar 1989). Choosing this specification, a percentage change in all inputs can induce a change in output and/or in N.

Using a translog function,[2] (3) can be approximated by the following total cost function[3]:

$$\begin{aligned}\ln TC &= \alpha_0 + \alpha_Y \ln Y + \alpha_N \ln N + \alpha_L \ln P_L + \alpha_K \ln P_K + \alpha_E \ln P_E + \frac{1}{2}\alpha_{YY}(\ln Y)^2 \\ &+ \frac{1}{2}\alpha_{NN}(\ln N)^2 + \frac{1}{2}\alpha_{LL}(\ln P_L)^2 + \frac{1}{2}\alpha_{KK}(\ln P_K)^2 + \frac{1}{2}\alpha_{EE}(\ln P_E)^2 \\ &+ \alpha_{YN}(\ln Y)(\ln N) + \alpha_{YL}(\ln Y)(\ln P_L) + \alpha_{YK}(\ln Y)(\ln P_K) + \alpha_{YE}(\ln Y)(\ln P_E) \\ &+ \alpha_{NL}(\ln N)(\ln P_L) + \alpha_{NK}(\ln N)(\ln P_K) + \alpha_{NE}(\ln N)(\ln P_E) + \alpha_{LE}(\ln P_L)(\ln P_E) \\ &+ \alpha_{LK}(\ln P_L)(\ln P_K) + \alpha_{KE}(\ln P_K)(\ln P_E) + \alpha_T T \end{aligned} \tag{4}$$

To improve the efficiency of the estimation process, we will append, as is common practice, the factor share equations derived by applying Shepard's Lemma to (4). Note that there are only two linearly independent factor share equations since total shares for all three factors must sum to unity.

Linear homogeneity in factor prices is imposed on the cost function by the restrictions

$$\sum_i \alpha_i = 1 \;;\; \sum_i \alpha_{ij} = \sum_j \alpha_{ij} = 0 \;;\; \sum_i \alpha_{Yi} = 0 \;;\; \sum_i \alpha_{Ni} = 0 \tag{5}$$

where i,j = L,K,E.

2.2 Economies of density and scale

The inclusion of an indicator of the network size allows for the distinction of economies of density and economies of scale. Economies of density (ED_{TC}) are defined as the proportional increase in total cost resulting from a proportional increase in output, holding all input prices and the network size fixed. This is equivalent to the inverse of the

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[2] A translog function requires the approximation of the underlying cost function to be made at a local point, which in our case, is taken at the median point of all variables. Thus, all independent variables are normalised at their median value.

[3] This assumes that the firms optimise their production with respect to all input factors in the short run. In an paper (Filippini and Maggi 1992), a variable cost function has been estimated in order to test the validity of this assumption. It came out that the above assumption is valid in the present case.

elasticity of total cost with respect to the output (Caves, Christensen and Swanson 1985) :

$$ED_{TC} = \frac{1}{\frac{\delta \ln TC}{\delta \ln Y}} \qquad (6)$$

We will talk of economies of density if ED_{TC} is greater than 1, and accordingly, identify diseconomies of density if ED_{TC} is below 1. In the case of $ED_{TC}=1$ no economies or diseconomies of density exist. Economies of density exist if the average costs of a bus company decrease as output increases through higher frequency of bus services on the existing itinerary.

If not only the output but also the network size N is adapted to a change in the inputs, economies of scale occur. Here, economies of scale are defined as the proportional increase in total costs brought about by a proportional increase in output and in the indicator of network size, holding all other factors, constant. Economies of scale(ES_{TC}) can thus be defined as:

$$ES_{TC} = \frac{1}{\frac{\delta \ln TC}{\delta \ln Y} + \frac{\delta \ln TC}{\delta \ln N}} \qquad (7)$$

Again,we will speak of economies of scale if ES_{TC} is greater than 1, and accordingly, identify diseconomies of scale if ES_{TC} is below 1. Economies of scale are absent if average cost remains constant when a bus company adds a new stop to the network (creating also an additional output on this trunk) whithout changing the traffic intensity on its network.

2.3 Data and variables

For estimation, panel-data on the bus companies for the four years 1986, 87, 88 and 89 has been used. All data was taken from the federal transport statistics. Total cost is taken to be the total of expenditures of the bus companies. Output is measured in passenger kilometers and, alternatively in seat kilometers. The majority of the studies on cost structure in transport (for an overview see Gathon and Perelman 1987) use passenger and ton kilometers as the two outputs in multi-product framework. Because the bus companies only provide passenger transport, there is no scope for a multiproduct approach. While the use of passenger kilometers is common, this ouput indicator is affected by demand-side effects. Therefore, it is used here only for the estimation of the cost function in order to allow for comparisons with other studies on the subject. For the analysis of efficiency, we will rely in this study on the estimations based on the seat kilometers which is a pure supply indicator (see for the same approach Thiry and Lawarree 1988 and Gathon 1989). The use of passenger kilometers may lead to identification problems and can seriously hamper the results. It is not evident why cost should depend on the number of passengers on a bus - running an empty bus is not cheaper than running a full-one. Cost savings could be achieved by not supplying bus services at times of low demand. But this is difficult given the Swiss regulation which obligates bus companies to provide regular services. Therefore, in this study, the cost is conceived to be induced by the rolling capacity in terms of seat kilometers being provided regularly.

The prices of labour and energy are taken from the statistics as the outlay for a factor divided by the quantity consumed. Capital price is calculated from the residual capital costs divided by the capital stock (see Friedlaender and Wang Chiang 1983). Residual cost is total cost minus labor and energy cost. The capital stock is simply measured by the number of buses owned and operated by a company. Unfortunately no data is available which would allow to calculate the capital stock, using the capital inventory method. The use of a simple indicator is justified by the fact that the bus companies, in contrast to the railways, do not possess an important stock of capital apart from the rolling stock. As an indicator of the network size we use the number of stops (see Caves et al. 1984). The use of this indicator can be criticised on two grounds: First it does not capture the length of the network and second it does not take account of the network structure. A possible solution would be to use a dispersion index from the graph theory which contains information on the size and structure of the network (see Filippini 1991, Filippini and Maggi 1991). This involves important cartographic work because the network length and structure can neither be taken from the statistics nor easily be read from a map. It is foreseen to calculate this index in a later stage of the research. Table 1 gives some detail on the variables and their values for small, medium sized and large bus companies.

Table 1: Description of variables

Variables	Symbol	Unit of measurement	1. Quartile (small)	Median (medium)	3. Quartile (large)
Total Cost	CT	SwF.	170'407.7	546'180.6	1'251'736.1
Labour price	P_L	SwF.for worker unity	42539.89	57241.99	65123.77
Energy price	P_E	SwF./Khw	0.31979	0.37037	0.43562
Capital price	PC	SwF.for capital unity	309.2836	438.477	640.122
Capital	C	Number of buses	2	5	11
Output Output*	Y Y*	Seat-km Passenger-km	1'926'000 559'000	7'335'250 2'115'000	18'559'934 6'460'500
Network type	N	Number of stations	11	26	53

Using the indicators just described two variants of the total cost function are estimated. In the first variant the ouput is measured in passenger kilometers, whereas in the second variant, the amount of seat kilometers is used. This gives two variants presented in table 2 below.

As has become standard practice, the cost and share equations are estimated simultaneously using Zellner's (1962) Seemingly Unrelated Regression technique.

2.4 Estimation results

Estimation results and economies of density and scale in the case of total cost using the data and variable specifications described above are given in table 2. This table contains only the first order coefficients. The full regression results are presented in the appendix. Since total cost as well as the dependent variables are in natural logarithms and have been normalised, the second-order coefficients can be dismissed for the interpretation of the elasticities and the cost economies at the median point. Thus the first order coefficients are interpretable as cost elasticities evaluated at the sample median.

Table 2: Estimation results for the total cost function - first-order coefficients and indicators for returns to scale

	model 1 (Y= seat Km)	**model 2 (Y=passengers Km.)**
	parameter (t-values)	parameter (t-values)
output	0.689	0.455
(Y)	(24.291)	(19.747)
price of labour	0.801	0.801
(P_L)	(224.12)	(221.7)
price of energy	0.044	0.044
(P_E)	(29.372)	(28.683)
price of capital	0.154	0.153
(P_K)	(56.197)	(55.955)
number of stations	0.172	0.350
(N)	(5.072)	(10.213)
time trend	0.007	0.030
T	(0.475)	(1.462)
ED_{TC}	1.45	2.19
ES_{TC}	1.16	1.24

The results are satisfying in so far as all coefficients with exception of the shift variables are significant and carry the expected sign. As can be seen from the full results presented in the appendix, the corrected R^2 are also satisfying with values around 0.8. Comparing the coefficients in the two models demonstrates a considerable stability.

At the median, the cost elasticities with respect to factor prices are equivalent to the cost shares. Hence, labor accounts for 80% of the costs of an average bus company while energy accounts for 5% and capital for the remaining 15% of cost. Interestingly enough the share of energy is the same as in the case of railways in Switzerland and the US (see Filippini, 1991, Caves, Christensen, Tretheway and Windle, 1985). The share of labour cost is considerably higher than in the case of the railways, where it amounts to around 50% only.

As could be expected, the influence of the network length on cost is positive. The cost elasticity is 0.35 in model 2 and 0.17 in model 1. Interestingly is to observe that the cost elasticity of model 1 is of the same order of magnitude as in the case of the US Bus Industry (see Windle , 1988). The higher cost elasticity with respect to seat kilometers is plausible given that this indicator will only show an increase in output if the supply is increased (additional seats and/or additional kilometers) while the number of passenger kilometers can increase due to increased demand only. This finding confirms our preference for model 1 for further analysis.

The coefficient for the network size is significantly higher in model 2. This instability in the coefficients could indicate some problems of collinearity between the output measures and the size indicator in terms of number of stops.

The shift factor for time is not significant in either of the two models, indicating that no neutral technical change is present in the four-year period.

The results indicate further that important economies of scale and density are present in the production of the Swiss regional bus companies. This will be discussed in the following section.

3 EFFICIENCY OF THE SWISS REGIONAL BUS COMPANIES

In this section, a closer look is taken at the estimation results as far as efficiency is concerned. Basically, two different approaches to efficiency are used. The first one is given simply by discussing the above results on economies of scale and density in order to identify efficiency. Scale efficiency indicates the degree to which a company is producing at optimal scale. Frisch (1965) defines the optimal scale as the level of operation where the scale elasticity is equal to one. In the present context, economies of scale and density are distinguished. Hence, efficiency can be defined in terms of scale and density. In order to have a better idea of the effects, Table 3 presents the results for small, medium-sized and large companies, respectively.

A first glance at the results in Table 3 reveals that all but one value of the indicator for economies of scale and density are greater than 1 which means that the majority of the Swiss bus companies operate at an inappropriately low scale and density level. Furthermore, all cost economies indicators decrease with increasing size. Hence, the importance of scale and density economies is decreasing with size.

Only in the case of large bus companies do we observe constant scale economies. Concerning large companies, it can be concluded, that they operate a network of optimal size, but that they fail to operate at a high enough intensity. With respect to the intensification of operation it must be noted that in reality, the demand met by these bus companies is often very limited and hence an intensification strategy might not be the best option.

Table 3: Economies of scale and density for three groups of railways[4]

	Economies of density	Economies of scale
small	1.78	1.50
medium sized	1.55	1.19
large	1.28	1.00

The finding that only the largest among the bus companies operate at a reasonable scale clearly indicates a potential for a merger policy. Without giving a detailed description of the situation it can be said that in our sample we find several constellations of bus companies where mergers would be feasible.

The above results for the scale efficiency will now be compared to the performance of the bus companies in terms of cost efficiency. Following Kopp and Diewert (1982) who extended Farrel's (1957) concept of efficiency to flexible and non-homothetic cost functions, an overall measure of cost efficiency may be defined as:

$$CE = \frac{C_F(Y, N, P_L, P_K, P_E, t)}{C_{Observed}} \qquad (8)$$

where CE is the indicator for cost efficiency and C_F is the estimated frontier cost function. This approach to efficiency results in an indicator which measures both allocative and technical efficiency. The indicator evaluates the actual cost of a firm by comparing it to the estimated frontier cost. The indicator thus takes the value of 1 for the most efficient company. A frontier cost function must be estimated from the actual data. This can be done by different approaches. A good overview is given by Thiry and Tulkens (1989). Among the methods they distinguish, the displaced ordinary least square (DOLS) approach is used in the present study. This approach has first been proposed by Greene (1980).The method consists in adjusting the constant term of the estimated cost function in a way which makes that all observations lie above or on the frontier and that at least one observation lies on the frontier. This is done by adjusting the constant term using the negative OLS residual with the highest absolute value. Greene (1980) has shown that the resulting constant term is consistent but biased and of unreliable efficiency.

Performing this analysis resulted in efficiency indicators varying between 0.78 for the least efficient and 0.99 for the second most efficient company.

4 OWNERSHIP, SUBSIDY STRUCTURE AND EFFICIENCY.

In this section, the performance of the bus companies will be discussed in terms of the efficiency indicators developed above. It should not be forgotten, however, that the

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[4] The economies of scale and density have been calculated at the input factor prices of the median company.

federal state as the regulatory agency attributes different or additional objectives to the bus companies. Thus, macro-economic (or social) objectives set by the regulator may or may not interfere with the micro-economic efficiency objectives of the companies. In this context, Rees (1984) cites allocative, distributional, financial and stabilisation objectives.

In Switzerland, the social goals attributed by the state to the public transport companies are defined as public service obligations. These include mainly objectives with a regional, social or environmental impact. The regional aspect concerns the obligation to serve the sparsely populated and mostly Alpine areas in Switzerland. The social policy enters, as usual, via the tariff policy. Transport firms are compensated for the provision of obligatory public services.

The main characteristics of the regulatory setting for the bus companies are:

- investments are subsidised by the Confederation and the Cantons,
- the Confederation and the Cantons cover the deficits of the companies,
- the Confederation compensates revenue reductions due to the provision of obligatory public services,
- the Confederation compensates for tariff-reductions in the case of companies operating in rural/alpine regions.

The equity shares are distributed among the three levels of the government sector and private persons and institutions. Two relevant features are to be noted. First, the regulatory agency is located on the level of the Confederation. Hence the Cantons and communes can only indirectly influence regulation. Second, while a profit would be distributed among all shareholders, the deficit and the investments are only subsidised by the Confederation and the Cantons. Moreover, the Confederation and the Cantons have to pay their subsidy share independently of their ownership share. Note also that the Cantons have to subsidise the bus companies without having a direct regulatory influence on their policy.

Schmidt and Lovell (1979) suggested to look at the relationship between the firm characteristics and the overall cost efficiency. We adopt this strategy and add the characteristics of the regulatory setting in order to perform an OLS regression with the efficiency indicator as the dependent variable.

We expect the distribution of the subsidies among the Confederation and the Cantons to be relevant for efficiency. A first consideration concerns the market area of the bus companies. Most of the companies serve a regional network. Therefore, one might argue that the most appropriate state-level for subsidising them would be the Cantonal level.

This would allow for a better control of the deficits because those who finance the company's deficit would be more or less identical with the users (in a spatial sense). In addition the good knowledge of the local market and the production context would induce an optimal investment policy.

The bus companies are obliged by the regulator to provide public services which they would not provide otherwise. These concern the provision of regular transport services in remote areas, the operation of buses at off-peak hours, setting social tariffs etc. The companies are compensated for the additional cost according to the amount of these kind of services produced and sold (in terms of passenger kilometers). This provides a positive incentive on efficiency because the companies are only compensated for the services they can sell. Hence they have an incentive to produce this obligatory output with a minimum of seat kilometers.

For reasons of regional equity, the Confederation obliges the bus companies which operate in rural areas with a high cost to approximate their tariffs on those of the Federal Railways. The companies are compensated for the difference between the costs and the approximated tariff. As the regulator has to rely on the cost information from the companies, this regulation provides no incentive to improve the efficiency. Cost savings would only result in a reduction of tariff subsidies.

In order to test the above hypotheses, the cost-efficiency indicator for 1988 (due to a lack of some data for 1989) has been regressed on indicators for the share of the Cantons in subsidies linked to the deficit (DEFCANT) and to the investments (INVCANT). A further variable (PUBSERV) measures the compensatory payments for the fulfilment of public service obligations in terms of the share of these payments in the turnover. A dummy-variable ALPINE is introduced. This variable takes the value of 1, if a company is operating in an Alpine Canton and 0 otherwise. This relates directly to the approximation of tariffs and the subsidies related to it. Finally, a variable (SIZE) is introduced which measures the share of the firm's revenue in the total revenue of the 62 bus companies. This variable should capture inefficiency effects due to bureaucracy problems in large companies.

Table 5 presents the results of this OLS regression on the 1988 data. The dependent variable is the natural logarithm of the indicator of cost efficiency (CE) calculated in the previous section. Because the efficiency indicator cannot take values greater than 1, a logarithmic transformation was chosen in order to get a better fit.

Table 5: The determinants of cost efficiency of Swiss regional bus companies in 1988 (OLS regression results)

Independent variables	parameter (t-values)
DEFCANT	0.0501 (2.88)
INVCANT	-0.0311 (-1.28)
PUBSERV	0.0105 (2.34)
ALPINE	-0.0177 (-2.05)
SIZE	-0.0074 (-2.42)
INTERCEPT	-0.2847 (-3.13)
R^2 (adj.)	0.26
Obs.	62

In accordance with our expectations, the share of the Cantons in subsidising the deficit has a significantly positive influence. Hence, there is some evidence in the data for the argument that the Cantons are the appropriate level of control for the operation of the bus companies. However, the share of the Cantons in the investment subsidies is not statistically significant. The results in table 5 further show that efficiency is positively and significantly correlated with the amount of compensation payments and the heading of "public service obligations". This is again in accordance with our above hypothesis. The same holds for the significantly negative sign of the variable ALPINE. This variable contains two different negative effects on efficiency. The first is given by the fact that , especially in winter, cost tends to be higher for bus companies operating in Alpine areas. A second negative impact is given by the fact that a bus company receives compensatory payements according to its own indications on the difference between costs and tariffs of the Federal Railways.

It is interesting to note that these findings confirm to a large extent the results found in a similar study on the Swiss private railways (Filippini, Maggi 1991).

5. CONCLUSIONS

This paper discussed efficiency in the context of the Swiss regional bus companies. For this purpose, cost functions were estimated for a sample of 62 of these companies over the period 1986-1989. By introducing an indicator for the network size in the cost function it has been possible to derive indicators for scale efficiency and density efficiency. An additional measure for efficiency was gained through the calculation of a frontier cost function and the calculation of an overall cost-efficiency index. The findings on efficiency were discussed in the political and regulatory setting to which the Swiss regional bus companies are submitted.

A first interesting result is that the degree to which the Cantons subsidise the deficits of the companies is positively correlated with the cost efficiency. Hence, the Cantons, i.e. its tax-payers, seem to have a clear interest that "their" company works efficiently. Moreover, it is found that the regulation concerning the public service obligations is not in conflict with the efficiency goal. On the contrary, the way in which the tariff subsidies are distributed gives a negative influence on efficiency. Overall, it can be said that in a federal state with a complex ownership and subsidy structure, private versus public ownership issues are probably of less relevance than questions relating to the adequate federal distribution of tasks and funds.

While the above conclusion on cost efficiency are of some interest, it should not be forgotten that in the given context of small bus companies, the question of the optimal scale is of much more relevance. Our findings show that these companies are mostly not operating at an optimal scale and density. While the scale inefficiency problem could be tackled through a merger strategy, an intensification of operation might be faced with a problem of lacking demand.

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Appendix

Table A1: Complete estimation results for the total cost function

	Model I (Y=Seat Km)	Modell II (Y= Passenger Km)
	Parameters (t-values)	Parameters (t-values)
α_0	13.266 (275.00)	13.120 (211.498)
α_Y	0.689 (24.291)	0.455 (19.747)
α_N	0.172 (5.072)	0.350 (10.213)
α_L	0.801 (224.12)	0.801 (221.7)
α_C	0.154 (56.197)	0.153 (55.955)
α_E	0.044 (29.372)	0.044 (28.683)
α_{YY}	0.038 (1.215)	0.041 (2.090)
α_{NN}	-0.0554 (-1.079)	0.107 (2.079)
α_{LL}	0.108 (17.333)	0.091 (13.236)
α_{CC}	0.071 (18.846)	0.066 (16.522)
α_{EE}	0.033 (13.947)	0.028 (11.688)
α_{YN}	0.085 (2.159)	0.0129 (0.436)
α_{YL}	-0.018 (-4.826)	-0.008 (-3.013)
α_{YC}	0.008 (3.026)	0.003 (1.674)
α_{YE}	0.009 (5.755)	0.004 (3.986)
α_{NL}	0.015 (2.889)	0.006 (1.350)
α_{NC}	-0.012 (-3.049)	-0.007 (-2.015)
α_{NE}	-0.002 (-1.284)	0.0008 (0.443)
α_{LE}	-0.035 (-11.762)	-0.027 (-8.488)
α_{LC}	-0.073 (-16.265)	-0.064 (-13.121)
α_{CE}	0.001 (0.857)	-0.001 (-0.903)
α_T	0.007 (0.475)	0.030 (1.462)
R^2	0.886	0.798