I. R. E. S.
Istituto Ricerche Economico-Sociali "Aldo Valente"
T O R I N O

THE ECONOMETRIC MODEL FOR THE REGIONAL PLANNING OF PIEDMONT

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1. Econometric models can help in solving the problems of economic policy in several ways:

   a) They can indicate the statistical data that we have to collect in order to get the information we need on some economic structures and processes. The requirements which have to be satisfied in order to aggregate or compare data are also clarified.

   b) Econometric models make it possible to compute the values of aggregated and sophisticated variables (like the total employment, the rate of growth of an industry, and so on) on the basis of values of elementary variables (changes in labour and capital coefficients, etc). Therefore we need to guess the latter variables and not the former ones. The values that the elementary variables are likely to assume can be visualized by the technicians, while the values of the aggregated and derived values are difficult to forecast.

   c) On many elementary variables various sets of guesses may appear to be reasonable. The econometric models allow the explanation of the economic and demographic implications of the various sets of reasonable guesses.

   d) When the objectives of the economic policy can be expressed as values of some magnitude that has to be reached or to be maximized, the econometric model can be transformed into a mathematical programming model (decision model): the optimum values of the instrumental variables of the Public Administration can then be computed.

2. The goals of a regional plan can be divided into two groups.

   1) Goals that, according to the results of partial analysis of specific economic activities or of particular zones , have to

be pursued in a univocal way. The results of the public action that are required to reach such goals can be assessed by partial analysis.

2) Goals that are pursued by actions that can be conceived in alternative ways, and that have to be evaluated both in their direct and in their indirect effects.

In a developed region like Piedmont the productivity goals for agriculture can be considered as indipendent from the level of production of the various industries. In fact we can establish minimum levels of the labour productivity in agriculture that have to be reached in the short period of the plan in order to stabilize a reduced employment in the sector. Given the technological possibilities, the socio-institutional obstacles, the instruments of economic policy that can be made available, we can estimate by what changes such productivity targets can be reached. Social capital targets (hospitals, schools, roads, etc.) cannot be determined univocally: they depend on the various levels that the economic activities can reach in the various zones characterized by different needs of adjustments in the social capital and by different marginal input of social capital for an additional inhabitant.

The achievement of the goals of the second kind can be assessed only by the application of an econometric model.

3. For the various economic regions (highly industrialized, depressed or underdeveloped industries) different kinds of econometric analysis are required. We shall confine ourselves to the analysis for highly industrialized industries. Analysis of the various industries, of agriculture and of the tertiary sectors are carried out in order:

be pursued in a univocal way.

2) Goals that are pursued by actions that can be conceived alternative ways, and that have to be evaluated both in their direct and in their indirect

In a developed region like Piedmont the productivity level of production of the various

that have to be reached in the short period of the plan in order to stabilize a reduced employment in the sector. Given the

1) to make reasonable guess on the national and international demand for the commodities produced by the autonomous industries (i.e. industries having a national wide market, that are present in the region because of its localization advantages, or because of historical reasons). The production exported outside the region can be evaluated by subtracting from total production the quantity consumed in the region. The latter variable is estimated ex ante, before the solution of the model. By an iterative process we can assure that the ex ante evaluation will correspond to the evaluation implied by the solution of the model;

2) to single out the specific problems of the various sectors and the goals of the first kind. In connection with such problems we can determine the most efficient tools to implement the regional policy. Then it is possible to establish the level at which the goals can be reached and the consequences that the economic policy may have on the coefficients by which we can interpret the actual structure of the economy;

3) to evaluate the coefficients and the parameters by which we can describe the actual structure, and to get information on the possible changes that such parameters will undergo in the future. Such changes may be caused by exogenous events (technical progress, for instance, which exerts a great influence on the labour input coefficients) or by events that the plan wants to produce.

4. The distribution of the economic activities and of the population within the region has to be studied in order:

1) to determine a partition of the region in ecological areas. An ecological area is a connected zone equipped with social services and large enough to offer the facilities of the urban

demand for the commodities produced by t

production the quantity consumed in the region

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.ill correspond to the evaluation implied by the

2) to sumple out the specific problems or

be made and the consequently

3) to evaluate the coefficients and the parameters by wh

changes may be caused by exogenous events (technical progress,

life to its inhabitants. Such a partition is made on the basis of the actual trends, of some technological and sociological requirements and of the effects of the policy that can be pursued by the plan to reduce the day-migrations of the workers;

2) to determine the more efficient structure of the roads and public transportation linking up the region with other regions and the urban and industrial poles of the various ecological areas with one another. For Piedmont the research has led to one system only of efficient roads and public transportation, inasmuch the relative importance of the various poles could be easily assessed in advance and the need for connections with other regions could be determined independently from the level of activity of the various industries and of the various areas. In general the partition of the region in ecological areas and the determination of the best road and transportation system are two problems connected to each other that can be solved only by iterative processes to be carried on together with the process of solution of the model.

3) to evaluate:

   a) the need for social capital (roads, hospitals, schools, etc.) required to make the actual condition of each zone up to date,

   b) the value of the social capital required for an additional inhabitant of each zone;

   c) the quantity of houses occupied by the non agricultural population that have to be rebuilt. (Because of the large reduction in the agricultural population that can be foreseen, the houses that are required for such a population, and that actually exist, can be considered adequate).

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transportation in kibe up the region with other regions and (f

determine the most efficient structure of the roads and

a) the need for social capital (roads, hospi

5. For the model, beside the usual input-output coefficients and the consumption coefficients (of the well-known Leontief models) we had to estimate:

1) the commercial coefficients, i.e. the quantities of the input of commodity i required for the production of one unit value of commodity j (input coefficient) which can be supplied by the firms of the region. Each commercial coefficient is multiplied by a parameter λ_i that, in the positive application of of the model, is set equal to 1, while in the mathematical programming version will be considered as an instrumental variable expressing the effects of the decentralization policy envisaged by the plan;

2) the commercial coefficients for the capital stock input coefficients and for the consumption coefficients, which are defined in a similar way;

3) the industries allocation coefficients each determining the quota of the total production of a certain industry that will be localized in a certain region;

4) the employment allocation coefficients each determining the quantity of people employed in a certain area that live in a certain other area;

5) the non agricultural population of each area living in houses that have not to be rebuilt.

6. The level of activity of the tertiary sectors has been expressed by the number of the workers employed. Such a level depends:

a) on the number of workers employed in industries,

b) on the household income.

The ratio coefficients by which to express the above relations, are estimated on the basis of the actual trends and of the effects

are estimated on the basis of the

similar way

envisaged by the

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lain other ways:

of the policy envisaged by the plan.

The level of activity of tourism as well as its demand for goods has been estimated as exogenous variable.

We have distinguished the propulsive industries (mostly automobile and office supplies industries) from the other mechanical industries: for the former we have evaluated the specific perspective of the single firms.

The level of activity of constructions depends not only on the demand for their products, by industries and households (for the maintenance of their houses) but also on:

a) the needs for new houses in the various areas that we deem it convenient to keep it separate from other private demand since it depends, to a large extent, on social evaluations and political decisions;

b) the need for social capital required in the various areas for the additional population.

As we said, agriculture has been dealt with as an exogenous activity.

6. The exogenous components of the demand for the products of each industry are:

1) the demand by tourism
2) the demand entailed by autonomous investments
3) the demand for commodities used as capital goods by agriculture
4) the demand for intermediate products by agriculture
5) the demand of the products of construction required to make social capital up to date
6) the demand by the public Administration
7) the demand from outside the region for the autonomous sectors.

The level of activity of non-ira

Households incomes are made up by:

1) the wages paid by the industries and the tertiary sectors, depending on the level of their activities
2) the profits distributed by industries, which are supposed to be proportionated to their activities
3) mixed incomes earned by small entrepreneurs and craftmen, which include both capital and labour in comes
4) predetermined incomes (not depending on the solution of the model) i.e. agricultural incomes, salaries of civil servants, incomes earned by people working outside the region (that has to be guessed before the solution of the model and then eventually adjusted through an iterative process), pensions and social transferts by the Public Administration to the households

7. The variables of the model are:
   1) production levels of the various industries
   2) employment in tertiary sectors
   3) non agricultural population of the various zones
   4) household income
   5) percentages of the demands for the various capital goods (houses and social capital being included) maturing over the period, that will be satisfied by the production of the last year. The demand for capital goods employed by industries is supposed to be proportional to the increase in their production. The demand for capital goods by tertiary sectors is supposed to be proportional to the increase in the level of its employment. Such percentages depend on:
   6) the rate of growth of industrial production, of employment in the tertiary sector, of the non agricultural population living in houses not to be rebuilt and of the population of each zone.

4) predetermined incomes (not depending on the solution of

ing on the level of their activi-

2) the profits distributed by indus-

proportionated to their activities

8. The equations of the model state:

1-2) the production of each industry (for the non autonoumos industries the production not exported outside the region) must be equal to the quantities demanded as intermediate products and as capital goods (for the quota charged on the last year) by the industries and the tertiary sectors, plus the quantities consumed by the households plus the exogenous demand (for the autonomous industries the exoge= nous demand includes also the exports outside the region). For the construction industry , demand for houses and for social capital has to be added.

3) population in each zone depends on the population working in the various areas and willing to reside in the zone. The population working in the various areas depend on the coefficients for the allocations of the industries and tertiary among the various zones.

4) the employment in the tertiary sectors depends on the variables which we have already recalled

5) households' income is made up of the components already recalled

6) the definition of the rate of increase in the industrial production for each industry

7) the definition of the rate of increase in the employment of the tertiary sectors

8) the definition of the rate of increase in the non agricultural popula= tion living in houses not to be rebuilt

9) the definition of the rate of increase in the population of each zone,

10-13) the quotas of investments, of the values of the houses to be built and of the social capital to be produced at the terminal year

9. The model is not a linear model. To solve it we have single out the Leontief part of the model transfering the other terms including unknown to the other side of the equations (the side of the predetermined values). Wehave then applied a process of iteration starting from ex ante

The equations of the model are:

coefficients

zones.

the employment in the tertiary sectors depends on the variables

recalled

the definition of the rate of increase in the non agricultural popula

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values of the various unknowns: the process has come out to be convergent and has been stopped when a 3% difference between the ex ante and ex post values of the unknowns (resulting from the solution of the model) has been reached.

9. On the basis of the solution of the model financial accounts have been drawn both for the various public administrations, on the basis of coefficients previously estimated linking the financial revenues with the values of the unknowns given by the model), and for the regional a s a whole. The financial implications of the policy envisaged by the plan can thus be assessed.

10 The computation procedure has been planned in such a way that all explorations of alternative sets of guesses can be easily done: their economic spatial and financial implications can be obtained very quickly.

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quickly.

1. The symbols

A. UNKNOWNS

The unknowns expressed in monetary values are all in 1963 prices.

x_j = value of the production of the j industry in the terminal year ($j = 1, 2 \ldots 16$)

y_s = number of workers in the tertiary sectors (the transport sector being excluded) in the terminal year

x_r = personal income in the terminal year

z_h = inhabitants of the h zone in the terminal year ($h = 1, 2 \ldots 15$)

ε_j = quota of the investments of the j industry for the planning period to be imputed to the terminal year (which depends on the rate of growth r_j)($j = 1, 2 \ldots 16$)

ε_s = quota of the investments of the tertiary sectors for the planning period to be imputed to the terminal year (which depends on the rate of growth r_s of employment in these sectors)

ε_c = quota of the value of the houses to be built in the period for the non agricultural population to be imputed to the terminal year (which depends on the rate of growth r_c)

ε_h = quota of the value of the social capital (roads, hospitals, schools, etc.) required for an additional inhabitant in the h zone to be imputed to the terminal year (the quota depends on the rate of growth r_h; $h = 1, 2 \ldots 15$)

r_j = yearly rate of growth of production in industry j ($j = 1, 2 \ldots 16$)

r_s = yearly rate of growth of employment in the tertiary sectors

A. UNKNOWNS

The unknowns expressed in monetary values are all in 1903 prices.

X_j = value of the production of the j industry in the terminal year ($j = 1,2, \ldots, 16$)

X_a = number of workers in the tertiary sectors (the transport sector being excluded) in the terminal year

X_e = personal income in the terminal year

X_h = habitations of the h zone in the terminal year ($h = 1,2, \ldots, 13$)

E_j = quota of the investments of the j industry for the planning period to be imputed to the terminal year (which depends on the rate of growth r_j) ($j = 1,2, \ldots, 16$)

E_a = quota of the investments of the tertiary sectors for the planning period to be imputed to the terminal year (which depends on the rate of growth r_a of employment in these sectors)

E_c = quota of the value of the houses to be built in the period for the non agricultural population to be imputed to the terminal year (which depends on the rate of growth r_c)

E_h = quota of the value of the social capital (roads, hospitals, schools, etc.) required for an additional inhabitant in the h zone to be imputed to the terminal year (the quota depends on the rate of growth r_h) ($h = 1,2, \ldots, 13$)

r_j = yearly rate of growth of production in industry j ($j = 1,2, \ldots, 16$)

r_a = yearly rate of growth of employment in the tertiary sectors

r_c = yearly rate of growth of the non agricultural population living in houses non to be rebuilt in the period

r_h = yearly rate of growth of the population in the h zone (h = 1, 2 .... 15)

B - PREDETERMINED AND EXOGENOUS VARIABLES

I) Values of production, of employment and of population parameters at the initial year

1) x_j° = current value of production in industry j (j = 1, 2... 16)

2) y_s° = employment in tertiary sectors

3) o_{ah}° = number of workers employed in the agriculture in zone h

4) o_d° = employment in agriculture

5) p_h° = non agricultural population of zone h living in houses which do not need to be built or rebuilt in the period

6) z_h° = non agricultural population living in zone h

7) σ_h = ratio between total population and active population in zone h.

II) Employment at the terminal year in the exogenous sectors

1) o_{ah} = number of workers employed in the agriculture of zone h

2) o_a = (= $\sum_h o_{ah}$) total employment in agriculture

3) o_t = number of workers employed in the tourism sector

4) o_e = number of workers living in the region and working outside the region

5) o_d = number of workers and employees of the Public Administrations

6) ξ_{dh} = quota of the workers and employees of the Public Administrations living in zone h.

III) Incomes at the terminal year per unit of employment in the exogenous sectors

1) p_{na} = net product per worker in agriculture

2) s_d = wage rate in the Public Administration sector

3) s_e = wage rate per worker employed outside the region

IV) Other exogenous incomes at the terminal year

1) T_h = social transferts from the "Comuni" Administration of zone h to the households

2) T_d = social transferts from the "Provincie" Administrations to the households

3) P = pensions paid to the households

V) Exogenous components of the final demand

1) D_{i1} = current expenditure on good i by the tourism sector

2) D_{i2} = current expenditure on good i for autonomous industrial investments

3) D_{i3} = current expenditure on good i for investment by agriculture

4) D_{i4} = current expenditure on single use good i by agriculture

5) D_{i5} = current expenditure on good i for investment in social capital adjustment

6) S_{dh} = quota of the workers and employers of the Public Administrations living in zone h.

iii) Incomes at the terminal year per unit of employment in the exogenous sectors

1) Pm_g = net product per worker in agriculture

2) w_g = wage rate in the Public Administration sector

3) w_g = wage rate per worker employed outside the region

IV) Other exogenous incomes at the terminal year

1) T_h^c = social transfers from the "Central" Administration of zone h to the households

2) T_h^r = social transfers from the "Provincial" Administrations to the households

3) P_h = pensions paid to the households

V) Exogenous components of the final demand

1) D_{1i} = current expenditure on goods of the tourism sector

2) D_{1i} = current expenditure on goods of autonomous industrial investments

3) D_{1i} = current expenditure on goods of the industries of agriculture

4) D_{1i} = current expenditure on single use goods by agriculture

5) D_{1i} = current expenditure on goods of the industries of social capital advantages

6) D_{i6} = current expenditure on good i by the Public Administration sector

7) D_{i7} = exports of good i

VII) Number of years in the period

1) T = number of years in the period

C - COEFFICIENTS

I) Technical coefficients for the intermediate commodities and for labour, and consumption coefficients (values at the terminal year)

1) a_{ij} = monetary value of commodity i used for the production of a unit value of the commodity by industry j (i, j=1, 2....16)

2) a_{is} = monetary value of commodity i used by the tertiary sectors for the employment of one worker (i = 1, 2 .... 16)

3) o_j = quantity of labour employed for the production of a unit value of commodity by industry j (j = 1, 2 ... . 16)

4) o_s = quantity of labour employed in the tertiary sectors which are complementary to the industry for the employment of one industrial worker

5) o_{sr} = quantity of labour employed in the commercial sector for the activity required in connection with the expenditure of a unit value of the personal income

6) c_i = quota of the personal income spent on commodity i (i = 1, 2...16)

II) Technical coefficients for capital goods, houses and social capital (values at the terminal year)

1) b_{ij} = monetary value of commodity i employed as a capital good for the production of one unit of commodity j(i,j = 1, 2...16)

2) b_{is} = monetary value of commodity i employed as a capital good in the tertiary sectors in connection with the employment of one worker (i = 1, 2....16)

3) ω_{ih} = value of the social capital (hospitals, schools, roads, etc.) which is required for one more inhabitant in zone h (h = 1, 2...15)

4) δ_c = value of the houses required for one additional unit of the non agricultural population

III) Commercial coefficients

1) α_{ij} = quota of the input a_{ij} supplied by firms of the region (i, j = 1, 2.... 16)

2) α_{is} = quota of the input a_{is} supplied by firms of the region (i, = 1, 2.... 16)

3) β_{ij} = quota of the input b_{ij} supplied by firms of the region (i, j = 1, 2 .... 16)

4) β_{is} = quota of the input b_{is} supplied by firms of the region (i = 1, 2.... 16)

5) γ_i = quota of the consumption of commodity i for one unit of personal income, which is supplied by firms of the region (i = 1, 2.... 16)

6) e_i = quota of the production of sector i which is exported outside the region

IV) Income coefficients (values at the terminal year)

1) s_i = wage rate of industry i (i = 1, 2.... 16)

2) s_s = wage rate in the tertiary sectors

3) π_i = distributed profit margin of industry i (i = 1, 2.... 16)

4) π_s = distributed profit per worker in the tertiary sector

5) μ_i = distributed mixed (capital and labour) income per unit of production in industry i (i = 1, 2.... 16)

6) μ_s = distributed mixed (capital and labour) income per worker in the tertiary sectors

π^0_{ij} = value of the bonuses required for one additional unit of

λ_i = quota of the consumption of commodity i for one unit of

V) Coefficients for the allocation of economic activities among the ecological areas

1) ξ_{ih} = quota of the production of industry i localized in area h ($i = 1, 2 \ldots 16$, $h = 1, 2 \ldots 15$)

2) ξ_{sh} = quota of the tertiary activities localized in area h ($h = 1, 2 \ldots 15$)

3) ν_{hk} = quota of the population increase induced by the industrial development of area k, which resides in area h ($h, k = 1, 2 \ldots 15$)

VI) Population coefficients

1) σ_h = ratio between total population and active population in area h ($h = 1, 2 \ldots 15$)

2) ρ_j = ratio between active industrial population of the sector j (employed or unemployed) and the number of workers employed in industry j ($j = 1, 2 \ldots 15$)

3) ρ_s = ratio between active population of the tertiary sectors and the number of workers employed in the same sector

4) ρ_d = ratio between active population in the Public Administration and the number of workers employed in the same sector

V) Coefficients for the allocation of economic activities among the geological areas

1) ξ^{ij}_{kh} = quota of the production of industry j localized in area k ($i = 1,2,\ldots,16$; $h = 1,2,\ldots,15$)

2) ξ^{ij}_{kh} = quota of the tertiary activities localized in area k ($h = 1,2,\ldots,15$)

3) ν^{ij}_{kh} = quota of the population increase induced by the industrial development of area k which reaches in area h ($h,k = 1,2,\ldots,15$)

VI) Population coefficients

1) θ^{j}_{h} = ratio between total population and active population in area h ($h = 1,2,\ldots,15$)

2) θ^{j}_{1} = ratio between active industrial population of the sector j (employed or unemployed) and the number of workers employed in industry j ($j = 1,2,\ldots,15$)

3) θ^{j}_{2} = ratio between active population of the tertiary sectors and the number of workers employed in the same sector

4) θ^{j}_{3} = ratio between active population in the Public Administration and the number of workers employed in the same sector

$$\text{I)}\quad (1-\lambda_{ei})x_i - \lambda_i \sum_j^{16} \alpha_{ij} a_{ij} x_j - \lambda_i \sum_j^{16} \beta_{ij} b_{ij} \varepsilon_j (x_j - x_j^\circ) - \lambda_i \alpha_{is} a_{is} y_s - \lambda_i \beta_{is} b_{is} \varepsilon_s (y_s - y_s^\circ) - \lambda_i \gamma_i c_i x_z = \sum_\ell^7 D_{i\ell}$$

$$i = 1, 2, \ldots 13, 15, 16,$$

$$\text{II)}\quad x_{14} - \lambda_{14} \sum_j \alpha_{14j} a_{14j} x_{14} - \lambda_{14} \sum_j^{16} \beta_{14j} b_{14j} \varepsilon_{14} (x_j - x_j^\circ) - \lambda_{14} \alpha_{14s} a_{14s} y_s - \lambda_{14} \beta_{14s} b_{14s} \varepsilon_s (y_s - y_s^\circ) - \lambda_{14} \gamma_{14} c_{14} x_z - \varepsilon_c \delta_c \sum_h (z_h - p_{hl}^\circ) -$$

$$- \sum_h \varepsilon_h \omega_h [z_h - z_h^\circ + \sigma_h o_{ah} - \sigma_h^\circ o_{ah}^\circ] = \sum_\ell^6 D_{i\ell}$$

$$\text{III)}\quad - \sigma_h \sum_k \nu_{hk} \sum_j \varsigma_{jk} \varrho_j o_j x_j - \sigma_h \sum_k \nu_{hk} \varsigma_{sk} \varrho_s y_s + z_h = \sigma_h \sum_k \nu_{hk} \varsigma_{dk} \varrho_d c_d$$

$$h = 1, 2, \ldots 15$$

$$\text{IV)}\quad - \sum_j^{16} o_s o_j x_j + y_s - o_{sz} x_z = o_t$$

$$\text{V)}\quad - \sum_j^{16} (s_j o_j + \pi_j + \mu_j) x_j - (s_s + \pi_s + \mu_s) y_s + x_z = p_{na} o_a + s_d c_d +$$

$$+ s_e o_e + \sum_h T_h + T_d + P$$

vi) $x_j = x_j^\circ (1 + r_j)^T \qquad j = 1, 2, \dots 16$

vii) $y_s = y_s^\circ (1 + r_s)^T$

viii) $\sum_h z_h = (1 + r_c)^T \sum_h p_h^\circ$

ix) $z_h + \sigma_h O_a = (z_h^\circ + \sigma_h^\circ O_a^\circ)(1 + r_h)^T$

x) $\varepsilon_j = \dfrac{r_j (1 + r_j)^{T-1}}{(1 + r_j)^T - 1} \qquad j = 1, 2, \dots 16$

xi) $\varepsilon_s = \dfrac{r_s (1 + r_s)^{T-1}}{(1 + r_s)^T - 1}$

xii) $\varepsilon_c = \dfrac{r_c (1 + r_c)^{T-1}}{(1 + r_c)^T - 1}$

xiii) $\varepsilon_h = \dfrac{r_h (1 + r_c)^{T-1}}{(1 + r_c)^T - 1}$

$h = 1, 2, \dots 15$

$e_i = 0$ per $i < 10$

The model for the iterative process

$$(1 - e_i)\, x_i - \sum_j \alpha_{ij}\, a_{ij}\, x_j - \gamma_i\, c_i\, x_z = \sum_p D_{ip} + D_{is} + J_i + K_i$$

$$-\sum_j (\beta_j o_j + \pi_j + \mu_j)\, x_j + x_z = p_{na}\, o_a + s_d\, o_d + s_e\, o_e + \Sigma_h T_h + T_d + P$$

$$\sim \cdot \sim$$

$$J_i = \sum_j^{16} \beta_{ij}\, b_{ij}\, \varepsilon_j (x_i - x_j^\circ) + \beta_{is}\, b_{is}\, \varepsilon_s (y_s - y_s^\circ)$$

$$D_{is} = \alpha_{is}\, a_{is}\, y_s$$

$$y_s = \sum_j^{16} o_s\, o_j\, x_j + o_{sz}\, x_z + o_t$$

$$z_h = \sigma_h \sum_k \nu_{hk} \left[\sum_j \zeta_{jk}\, e_j\, o_j\, x_j + \zeta_{sk}\, e_s\, y_s + \zeta_{dk}\, e_d\, o_d \right]$$

$$K_{14} = \varepsilon_c\, \delta_i \sum_h (z_h - p_h^\circ) + \sum_h \varepsilon_h\, \omega_h \left[z_h - z_h^\circ + \sigma_h\, o_{ah} - \sigma_h^\circ\, o_{ah}^\circ \right]$$

$$K_j = 0 \qquad \text{per} \quad j \neq 14$$

$$c_j = x_j^\circ \left(1 + r_j\right)^T \quad j = 1, 2, \ldots 16 \qquad y_s = y_s^\circ \left(1 + r_s\right)^T \qquad \sum_h z_h = \left(1 + r_c\right)^T \sum_h p_h^\circ \qquad z_h + \sigma_h O_a = \left(z_h^\circ + \sigma_h^\circ O_h^\circ\right)\left(1 + r_h\right)^T$$

$$h = 1, 2, \ldots 15$$

$$\varepsilon_j = \frac{r_j \left(1 + r_j\right)^{T-1}}{\left(1 + r_j\right)^T - 1} \qquad \varepsilon_s = \frac{r_s \left(1 + r_s\right)^{T-1}}{\left(1 + r_s\right)^T - 1} \qquad \varepsilon_c = \frac{r_c \left(1 + r_c\right)^{T-1}}{\left(1 + r_c\right)^T - 1} \qquad \varepsilon_h = \frac{r_h \left(1 + r_c\right)^{T-1}}{\left(1 + r_c\right)^T - 1}$$

B - Predetermined and exogeneous variables

I. 2 :	y°_{s} =	309. 521
I. 4 :	o°_{d} =	82. 663
II. 2 :	o_{a} =	275. 000
II. 3 :	o_{t} =	22. 974
II. 4 :	o_{e} =	13. 000
II. 5 :	o_{d} =	99. 164
III. 1:	p_{na} =	0, 01124000
III. 2:	s_{d} =	0, 01836265
III. 3:	s_{e} =	0, 01500000
IV. 3:	P =	3555, 18
VI. 1:	T =	7
IV. 2:	T_{d} =	11, 12

B - PREDETERMINED AND EXOGENEOUS VARIABLES

Industries	I.1 x_j^o	V.1 D_{i1}	V.2 D_{i2}	V.3 D_{i3}	V 4 D_{i4}	V.5 D_{i5}	V.6 D_{i6}	V.7 D_{i7}
1 - Propulsive ind.	10.624,70			22,47				17.496,73
2 - Metals engineering	10.015,21			15,00	70,00		502,88	9.092,21
3 - Textiles	4.299,10						54,65	4.178,36
4 - Clothing	1.229,90	22,00					59,62	920,92
5 - Chemicals	2.880,30				40,00		425,53	2.712,13
6 - Food and drink	3.405,80	43,00			104,00		178,59	2.884,36
7 - Leather	419,40							420,30
8 - Pulp mills and paper	687,80						31,92	428,22
9 - Mining and non Ferrous metal	1.417,60						121,56	500,00
10 - Timber Furniture	969,60				13,00		23,80	424,26
11 - Rubber and tires	1.517,30						17,26	117,52
12 - Polygraphic Ind. and Publishing	720,00	11,00					53,00	300,00
13 - Other manufactures	471,40	11,00						109,00
14 - Contruction	4.197,60	336,19		160,00	30,00	1.424,50	437,24	
15 - Electricity, gas and water	1.333,90				50,00		23,64	
16 - Transport and communications	2.496,00	44,00					97,44	203,00 (1)

(1) - Public financial contributions

Industries	E1 x_1^*	V.1 D 11	D 12	V.2	V.3 D 21	D 22	V.4 D 31	V.5 D 32	V.6 D 41	V.7 D 42
1 - Agriculture	[illegible]				42, 47					17, 496, 73
2 - Metals Manufacturing	[illegible]				15, 00		12, 00		502, 88	9, 092, 21
3 - Textiles	[illegible]								56, 05	4, 178, 16
4 - Building	[illegible]		41. 00						5n, 04	920, 02
5 - Chemicals	[illegible]						10, 00		427, 37	3, 712, 13
6 - Food and Drink	[illegible]		91. 00				104, 00		178, 34	2, 884, 16
7 - Leather	[illegible]									120, 10
8 - Polymerics and Paper	[illegible]								11, 02	428, 12
9 - Mining and Extraction	[illegible]								121, 36	800, 00
10 - Energy Creating	[illegible]						11, 00		21, 00	134, 10
11 - Glass Ceramics	[illegible]								17, 26	117, 32
12 - Polygraphic Ind. and Publishing	[illegible]		11. 00						52, 00	200, 00
13 - Other Manufactures	[illegible]		11. 00							100, 00
14 - Construction	[illegible]		110. 10		110. 00		30, 00	1. 424. 50	417, 14	
15 - Electricity, Gas and Water	[illegible]						50, 00		21, 00	
16 - Transport and Communications	[illegible]		14, 00						17, 44	203, 00 00
17 - Public Services and Others										

B - PREDETERMINED AND EXOGENEOUS VARIABLES

Zones	I.3 o_{ah}	I.5 p_h	I.6 z_h	I.7 σ_h	II.1 o_{ah}	II.6 ξ_{dh}	IV.1 T_h
I - Torino	58.500	1.415.678	1.677.344	2,22	47.000	0,5181	3,01
II - Ivrea	12.900	61.916	81.148	2,11	10.000	0,0192	0,46
III- Pinerolo	13.900	67.771	83.155	2,19	11.000	0,0183	0,45
IV- Vercelli	19.800	61.135	79.915	2,20	16.000	0,0392	0,38
V - Borgosesia	5.000	53.631	71.129	2,06	4.000	0,0105	0,24
VI- Biella	6.900	134.348	169.846	1,99	6.000	0,0235	0,51
VII- Novara	20.300	164.689	213.882	2,18	15.000	0,0687	0,70
VIII- Verbania	7.500	156.997	185.576	2,27	6.000	0,0379	0,81
IX - Cuneo	24.800	64.134	84.276	2,25	20.000	0,0451	0,38
X - Saluzzo-Savigliano-Fossano	27.800	51.767	73.953	2,30	23.000	0,0234	2,05
XI- Alba-Bra	25.800	58.947	70.426	2,26	19.000	0,0231	0,61
XII- Mondovì	19.800	40.836	52.087	2,28	15.000	0,0203	0,42
XIII- Asti	39.700	91.989	110.299	2,18	32.000	0,0394	0,78
XIV- Alessandria	50.100	232.985	283.092	2,33	36.000	0,0943	6,82
XV- Casale Monferrato	19.300	53.037	64.917	2,21	15.000	0,0190	0,31

C - Coefficients

I) Labour coefficient (For the tertiary sectors)

4) o_s = 0,092871

5) o_{sr} = 6,8948

II) House construction input

4) δ_c = 0,01236750

IV) Income coefficients

2) s_s = 0,00534960

4) π_s = 0,01026703

6) μ_s = 0,01247897

VI) Population coefficients

3) ρ_s = 1,050

4) ρ_d = 1,000

CV - COEFFICIENTS

Zones	CII-Social capital coefficients 3) ω_h	CV-Coeff. for alloc. of tertiary employ. among zones 2) ξ_{sh}	CVI - Population coefficients 1) σ_h
I - Torino	0,0035152	0,5241	2,25
II - Ivrea	0,0030497	0,0244	2,17
III- Pinerolo	0,0030936	0,0225	2,25
IV- Vercelli	0,0029200	0,0293	2,24
V - Borgosesia	0,0031115	0,0147	2,08
VI - Biella	0,0030470	0,0398	2,02
VII- Novara	0,0030448	0,0594	2,33
VIII-Verbania	0,0031756	0,0497	2,38
IX - Cuneo	0,0032094	0,0312	2,33
X - Saluzzo-Savigliano-Fossano	0,0032076	0,0255	2,32
XI - Alba-Bra	0,0031061	0,0242	2,30
XII- Mondovì	0,0030632	0,0180	2,41
XIII-Asti	0,0030049	0,0340	2,22
XIV-Alessandria	0,0029349	0,0826	2,38
XV- Casale Monferrato	0,0028686	0,0206	2,30

C I - INPUT COEFFICIENTS

1. a_{ij}

INDUSTRIES	Propulsive ind.	Metals engineering	Textiles	Clothing	Chemicals	Food and drink	Leather	Pulp mills and paper	Mining and non ferrous metal	Timber Furniture	Rubber and tires	Poligraphic Ind. and Publishing	Other manufactures	Contruction	Electricity, gas and water	Transport and communications
Propulsive ind.	0,017422	0,008881												0,000336		0,000508
Metals engineering	0,388527	0,410779	0,008214	0,000533	0,010955	0,009197	0,004545	0,027928	0,037086	0,012304	0,064657		0,047522	0,113964	0,118294	0,056083
Textiles	0,005053	0,001768	0,280000	0,375096	0,007757	0,000445		0,0033156	0,000117	0,002083	0,116055	0,000684	0,004260		0,000307	
Clothing	0,000141		0,000369	0,008223		0,000092	0,026941			0,000062				0,000176		0,000833
Chemicals	0,023484	0,019529	0,074224	0,020373	0,434233	0,015790	0,069483	0,138233	0,035954	0,014512	0,085000	0,050000	0,013718	0,019578	0,061850	0,112834
Food and drink	0,000235				0,007604	0,160523			0,000029		0,001631					
Leather	0,001098	0,002295	0,000567	0,038840		0,000210	0,299913				0,000567		0,000895			
Pulp mills and paper	0,002561	0,003425	0,008093	0,004691		0,051019	0,000439	0,277997	0,022756	0,002362	0,041597	0,252848	0,012185	0,000305	0,002099	0,001137
Mining and non ferrous metal	0,014317	0,016395	0,006995		0,010371	0,014250		0,004244	0,197677	0,003930	0,058099		0,001704	0,204060	0,027034	0,000022
Timber Furniture	0,003155	0,004607	0,000643	0,000863	0,003761	0,004770		0,006450	0,001302	0,235269			0,005602	0,082927	0,001364	0,000366
Rubber and tires	0,048641	0,007062	0,001072	0,007008	0,001553	0,000419	0,001188	0,000689	0,002540	0,003321	0,083634	0,000160	0,002130	0,002351	0,033864	0,034124
Polygraphic Ind. and Publishing	0,003311	0,000349	0,001484	0,000107	0,016744	0,007540	0,000569	0,000644	0,003798	0,000072	0,030386	0,085640	0,002599	0,000193	0,007992	0,003658
Other manufactures	0,000254	0,005200	0,000914	0,007615	0,003747	0,021715	0,000103	0,007921	0,008180	0,002888	0,004765	0,004874	0,000213	0,001544		0,000116
Contruction	0,002096	0,004281	0,003686	0,004854	0,004763	0,006428	0,003696	0,002835	0,006292	0,001970	0,003256	0,008695	0,004009		0,061691	0,002288
Electricity, gas and water	0,017625	0,018704	0,019366	0,006309	0,018851	0,009431	0,009814	0,030107	0,068682	0,013223	0,026041	0,005993	0,002338	0,009918	0,249188	0,006204
Transport and communications	0,015390	0,014015	0,011559	0,013130	0,019000	0,029810	0,008111	0,016808	0,040381	0,017749	0,024642	0,024924	0,006993	0,015336	0,029208	0,023322

C III - COMMERCIAL COEFFICIENTS

1. α_{ij}

INDUSTRIES	Propulsive ind.	Metals engineering	Textiles	Clothing	Chemicals	Food and drink	Leather	Pulp mills and paper	Mining and non ferrous metal	Timber Furniture	Rubber and tires	Poligraphic Ind. and Publishing	Manifat- Other manufactures varie	Contruction	Electricity, gas and water	Transport and communications
Propulsive ind.	1,0000000	1,0000000												1,0000000		1,0000000
Metals engineering	0,3492936	0,4252545	0,1903784	0,0806452	0,5850209	0,7582311	0,9034091	0,4306089	0,2714571	0,8382230	0,3158587		0,2545944	0,4355833	0,3291083	0,5857302
Textiles	0,4919866	0,8768415	0,2217072	0,7734997	0,3018611	0,8400000		0,2912621	0,8805031	1,0000000	0,1623488	0,1489362	1,0000000		1,0000000	
Clothing	1,0000000		0,4509804	0,7562438		0,3225800	0,0201342			0,8333333				0,5370370		1,0000000
Chemicals	0,1841440	0,4673037	0,6700243	0,6923387	0,2900000	0,2939445	0,7074349	0,1400000	0,1665604	0,3702914	0,1563955	0,7320261	0,2329193	0,6556017	0,5438797	0,2614321
Food and drink	1,0000000				0,2343826	0,3115724					0,3086957					
Leather	0,2915952	0,5235540	1,0000000	0,4899358		0,5263158	0,2774955				0,8875000		0,2380952			
Pulp mills and paper	0,5967062	0,3679775	0,8728788	0,7740806	0,3143371	0,6667671	0,9411765	0,2909306	0,4795055	0,6812227	0,2006619	0,6751453	0,6573427	0,5212766	0,5219512	0,7963801
Mining and non ferrous metal	0,4167296	0,1858259	0,5136029		0,1779335	0,6924135		0,7292419	0,3200909	1,0000000	0,0349078		1,0000000	0,7859999	1,0000000	1,0000000
Timber Furniture	0,9704478	0,8773756	1,0000000	0,5714286	0,5505618	1,0000000		0,0522565	0,8295455	0,4795765			1,0000000	0,4500000	1,0000000	0,5000000
Rubber and tires	0,3800000	0,7829938	0,5101124	0,2473623	0,4580499	0,8794326	0,6956522	0,4444444	0,9825073	0,5372671	0,2219568	1,0000000	1,0000000	1,0000000	0,3320788	0,5780883
Poligraphic Ind. and Publishing	0,856653	0,7462687	0,9155844	0,9230769	0,4000000	0,5181782	1,0000000	0,5952381	0,3664717	0,2857143	0,1673279	0,8977408	1,0000000	0,6923077	0,5224072	0,8773333
Other manufactures	0,3703704	0,5431034	0,3130435	0,3633005	0,3493976	0,2396969	0,5000000	0,6325581	0,5377049	0,3714286	0,2247024	0,8835821	1,0000000	0,5221053		1,0000000
Contruction	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000
Electricity, gas and water	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	0,4175606	1,0000000
Transport and communications	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	1,0000000	0,7800000

C II - FIXED CAPITAL STOCK COEFFICIENTS

1. b_{ij}

Industries	1 Propulsive ind.	2 Metals engineering	3 Textiles	4 Clothing	5 Chemicals	6 Food and drink	7 Pelli Leather cuoio	8 Pulp mills and paper	9 Mining and non ferrous metal	10 Timber Furniture	11 Rubber and tires	12 Polygraphic Ind. and Publishing	13 Other manufactures	14 Contruction	15 Electricity, gas and water	16 Transport and communications
1 - Propulsive ind.	0,0024	0,0261	0,0203	0,0289	0,0261	0,0142	0,0298	0,0263	0,0368	0,0770	0,0263	0,0219	0,0300	0,0607	0,0035	0,7207
2 - Metals engineering	0,6309	0,6377	0,6915	0,5293	0,7253	0,2943	0,7154	1,0208	0,8278	0,6600	0,9026	0,5951	0,4458	0,1216	0,4859	1,9087
3 - Textiles																
4 - Clothing																0,0053
5 - Chemicals	0,0105	0,0017		0,0113	0,0003			0,0025	0,0309	0,0180						
6 - Food and drink																
7 - Leather																
8 - Pulp mills and paper																
9 - Mining and non ferrous metal																0,0053
10 - Timber furniture	0,0105	0,0017		0,0113	0,0003			0,0025	0,0309	0,0180						0,0100
11 - Rubber and tires	0,0105	0,0017		0,0113	0,0003			0,0025	0,0309	0,0180						
12 - Polygraphic Ind. -Publishing																
13 - Other manufactures																
14 - Contruction	0,1430	0,1746	0,1356	0,2123	0,1308	0,1107		0,1979	0,2304	0,2090	0,1678	0,2259	0,1242		0,9405	0,2500
15 - Electricity, gas and water																
16 - Transport and communications																

C III - COMMERCIAL COEFFICIENTS

3. β_{ij}

Industries	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Propulsive ind.	Metals engineering	Textiles	Clothing	Chemicals	Food and drink	Leather	Pulp mills and paper	Mining and non ferrous metal	Timber Furniture	Rubber and tires	Polygraphic Ind. and Publishing	Other manufactures	Contruction	Electricity, gas and water	Transport and communications
1 - Propulsive ind.	1,000000	1,000000	1,000000	1,000000	1 000000	1,000000	1,000000	1,000000	1,000000	1,000000	1,000000	1,000000	1,000000	1,000000	1,000000	1,000000
2 - Metals engineering	0,300000	0,214853	0,147415	0,180000	0 200000	0,395809	0,129685	0,138127	0,191333	0,336036	0,214019	0,300000	0,345972		0,368126	0,285818
3 - Textiles																
4 - Clothing																
5 - Chemicals	0,385802	0,801369			0,904762				0,158140	0,521595						
6 - Food and drink																
7 - Leather																
8 - Pulp mills and paper																
9 - Mining and non ferrous metal																
10 - Timber Furniture	0,385802	0,801369			0,904762				0,158140	0,521595						
11 - Rubber and tires	0,385802	0,801369			0,904762				0,158140	0,521595						
12 - Polygraphic Ind.-Publishing																
13 - Other manufactures																
14 - Contruction	1,000000	0,928799	0,970891	0,944723	0,997752	0,891609		1,000000	0,935521	1,000000	0,998458	0,717736	1,000000		1,000000	0,955634
15 - Electricity, gas and water																
16 - Transport and communications																

INDUSTRIES	C I INPUT COEFF. (FOR TERTIARY) LABOUR AND CONSUPTION COEFF.			C II FIXED CAP. STOCK COEFF. (FOR TERT.)	C III COMMERCIAL COEFFICIENTS				C IV INCOME COEFFICIENTS			C VI COEFFICIENTS POPULATION COEFFICIENTS
	2. a_{1s}	3. o_j	6. c_i	2. b_{is}	2. α_{1s}	4. β_{is}	5. γ_i	6. ρ_i	1. ε_i	3. η_i	5. μ_j	2. ξ_j
1 Propulsive ind.		9,501408	0,034395	0,0056034		1,0000000	0,850006		0,02356048	0,015000		1,018
2 Metals engineering	0,00041768	14,243047	0,013495	0,0097726	0,578899	0,2628735	0,554629		0,01406212	0,025000	0,0223005	1,120
3 Textiles	0,00002636	21,516303	0,013291		0,390686		0,522689		0,01011057	0,025000	0,0092835	1,030
4 Clothing	0,00029487	21,013431	0,055000		0,202257		0,600000		0,00878677	0,025000	0,0811190	1,265
5 Chemicals	0,00176844	9,750003	0,041135	0,0004192		0,2287917	0,500000		0,01325559	0,035000	0,0060685	1,035
6 Food and drink	0,00004533	7,727603	0,082691		0,650036		0,522365		0,01237693	0,030000	0,0120041	1,135
7 Leather	0,00003231	11,776913	0,002963				0,522285		0,01120587	0,025000	0,0078576	1,070
8 Pulp mills and paper	0,00033280	15,912225	0,001510				0,537105		0,01209834	0,030000	0,0102804	1,031
9 Mining and non ferrous metal	0,00010952	16,146088	0,000996		0,252212		1,000000		0,01290358	0,030000	0,0193564	1,090
10 Timber Furniture	0,00013789	19,008688	0,007014	0,0004192	0,582474	0,2287917	0,557569		0,00986258	0,025000	0,0951875	1,365
11 Rubber and tires	0,00007954	9,357470	0,002924	0,0004192	0,784728	0,2287917	0,756154	0,620	0,01686530	0,030000	0,0026047	1,028
12 Poligraphic Ind. and Publishing	0,00086666	13,387547	0,012756		0,096253		0,541274	0,270	0,01660522	0,030000	0,0224276	1,066
13 Other manufactures	0,00069504	8,508506	0,006900		0,026310		0,522094	0,448	0,01282591	0,025000	0,0243730	1,230
14 Contruction	0,00080469	19,310332	0,003489	0,0489828	1,000000	1,0000000	1,000000		0,01205724	0,025000	0,0232387	1,170
15 Electricity, gas and water	0,00045199	7,038180	0,019149		1,000000		1,000000		0,02188171			1,018
16 Transport and communications	0,00055466	24,920010	0,034002		1,000000		1,000000		0,01368296	0,025000	0,0456410	1,109

CV COEFFICIENTS FOR ALLOCATION OF ECOMONIC ACTIVITIES AMONG THE ECOLOGICAL AREAS

1. C_{jk}

ZONES	1 Propulsive ind.	2 Metals engineering	3 Textiles	4 Clothing	5 Chemicals	6 Food and drink	7 Leather	8 Pulp mills and paper	9 Mining and non ferrous metal	10 Timber Furniture	11 Rubber and tires	12 Poligraphic Ind. and Publishing	13 Other manufactures	14 Contruction	15 Electricity, gas and water	16 Transport and communications
I TORINO	0,8406	0,6050	0,2664	0,3849	0,3703	0,3062	0,7074	0,4180	0,2571	0,3786	0,7416	0,7120	0,7141	0,4048	0,5231	0,4666
II IVREA	0,1118	0,0168	0,0113	0,0110	0,0549	0,0113	0,0244	0,0054	0,0169	0,0157	0,0017	0,0126	0,0051	0,0289	0,0225	0,0135
III PINEROLO	0,0476	0,0093	0,0236	0,0110	0,0091	0,0159	0,0061	0,0271	0,0358	0,0392	0,0017	0,0063	0,0051	0,0242	0,0169	0,0150
IV VERCELLI		0,0149	0,0161	0,0211	0,0823	0,0340	0,0051	0,0109	0,0142	0,0313	0,0400	0,0126	0,0204	0,0311	0,0255	0,0249
V BORGOSESIA		0,0130	0,0920	0,0205	0,0018	0,0091	0,0024	0,1086	0,0380	0,0261	0,0017	0,0063	0,0051	0,0272	0,0099	0,0126
VI BIELLA		0,0207	0,3930	0,0422	0,0055	0,0159	0,0488	0,0109	0,0282	0,0261	0,0017	0,0126	0,0102	0,0538	0,0176	0,0311
VII NOVARA		0,0656	0,1165	0,1032	0,1406	0,0905	0,0447	0,0512	0,0427	0,0431	0,0075	0,0971	0,0242	0,0762	0,0940	0,0583
VIII VERBANIA		0,0539	0,0396	0,0543	0,1700	0,0365	0,0407	0,0682	0,1086	0,0744	0,0018	0,0226	0,0777	0,0789	0,1004	0,0540
IX CUNEO		0,0130	0,0047	0,0189	0,0091	0,0227	0,0061	0,0380	0,0565	0,0470	0,1000	0,0315	0,0102	0,0378	0,0278	0,0345
X SALUZZO-SAVIGL.-FOSSANO		0,0184	0,0095	0,0315	0,0061	0,0453	0,0024	0,0814	0,0335	0,0470	0,0035	0,0189	0,0051	0,0252	0,0221	0,0223
XI ALBA-BRA		0,0104	0,0057	0,0463	0,0210	0,1474	0,0366	0,0109	0,0223	0,0313	0,0070	0,0063	0,0051	0,0261	0,0147	0,0222
XII MONDOVI'		0,0110	0,0028	0,0189	0,0123	0,0181	0,0024	0,0326	0,0424	0,0313	0,0005	0,0063	0,0051	0,0222	0,0140	0,0242
XIII ASTI		0,0310	0,0028	0,0551	0,0091	0,1020	0,0024	0,0543	0,0847	0,0653	0,0175	0,0007	0,0104	0,0414	0,0190	0,0482
XIV ALESSANDRIA		0,1034	0,0141	0,1543	0,0988	0,1247	0,0634	0,0554	0,1118	0,1044	0,0703	0,0353	0,0920	0,0950	0,0742	0,1478
XV CASALE MONFERRATO		0,0136	0,0019	0,0268	0,0091	0,0204	0,0061	0,0271	0,1073	0,0392	0,0035	0,0189	0,0102	0,0272	0,0183	0,0248

CV - COEFFICIENTS FOR THE ALLOCATION OF THE POPULATION WORKING IN ZONE K AMONG THE VARIOUS ECOLOGICAL ZONES

3. ν_{hk}

Residence zone \ Employment zone	Torino	Ivrea	Pinerolo	Vercelli	Borgosesia	Biella	Novara	Verbania	Cuneo	Saluzzo Savigliano Fossano	Alba-Bra	Mondovì	Asti	Alessandria	Casale Monferr.
Torino	0,975	0,025													
Ivrea	0,002	0,967													
Pinerolo	0,008		1,000												
Vercelli	0,002	0,005		1,000											
Borgosesia					1,000										
Biella		0,003				1,000									
Novara							1,000								
Verbania								1,000							
Cuneo									1,000						
Saluzzo-Savigliano-Fossano	0,003									1,000					
Alba-Bra	0,004										1,000				
Mondovì												1,000			
Asti	0,006												1,000		
Alessandria														1,000	
Casale Monferrato															1,000

Tab. 1

THE SOLUTION OF THE MODEL PRODUCTION AND EMPLOYMENTS

Industries	Production at 1970	Yiearly rate of growth	Employment at 1970	Yiearly rate of growth
1 - Propulsive ind.	19.440	9,0	184.706	3,25
2 - Metals engineering	17.445	8,25	264.618	2,10
3 - Textiles	5.681	4,0	123.451	- 1,10
4 - Clothing	2.326	9,5	58.650	1,85
5 - Chemicals	5.731	10,3	56.720	4,00
6 - Food drink	5.169	6,20	43.135	1,75
7 - Leather	607	5,5	7.511	0,25
8 - Pulp mills and paper	1.132	7,4	18.235	2,25
9 - Mining and nonferrous metal	2.444	8,3	40.846	2,05
10 - Timber Furniture	1.280	4,0	31.637	- 0,75
11 - Rubber and tires	2.348	6,5	22.187	1,30
12 - Polygraphic Ind. and Publishing	1.314	9,0	18.476	4,20
13 - Other manufactures	712	6,15	7.091	- 0,25
14 - Contruction	7.996	9,65	162.122	3,75
15 - Electricity, gas and water	2.609	10,2	18.361	4,85
16 - Transport and communications	3.280	4,0	89.099	0,90

Tab. 2

THE SOLUTION OF THE MODEL INVESTIMENT

	Investiment at 1970	Investiment over the period 1964 - '70
1 - Propulsive ind.	1297,99	7120,85
2 - Metals engineering	1114,51	6266,94
3 - Textiles	187,56	1170,80
4 - Clothing	161,69	881,60
5 - Chemicals	472,27	2517,84
6 - Food drink	124,88	738,94
7 - Leather	23,09	140,05
8 - Pulp mills and paper	96,56	556,83
9 - Mining and non ferrous metal	212,94	1219,38
10 - Timber Furniture	49,09	310,65
11 - Rubber and tires	153,89	910,57
12 - Polygraphic Ind. and Publishing	90,76	500,95
13 - Other manufactures	24,27	144,54
14 - Contruction	126,21	692,42
15 - Electricity, gas and water	336,37	1823,03
16 - Transport and communications	359,34	2274,15

Tab. 3

THE SOLUTION OF THE MODEL
TOTAL POPULATION AND ACTIVE POPULATION RESIDING IN THE VARIOUS ZONES

Zones	Total population		Perc Change 1963-'70	Number of non agricultural workers		Perc. Change 1963-'70	Perc. of non agricult. active population		Perc. of active popol. on total pop.	
	1963	1970		1963	1970		1963	1970	1963	1970
1 - Torino	1.775,3	2.044,7	15,1	743,9	846,9	13,8	90,0	91,1	44,9	44,3
2 - Ivrea	109,1	134,9	23,6	40,2	50,2	24,9	73,2	81,0	47,5	46,0
3 - Pinerolo	113,2	124,2	9,7	31,4	35,6	13,4	71,1	77,5	45,6	44,4
4 - Vercelli	124,4	132,8	6,7	31,9	39,4	23,5	62,3	70,2	45,4	44,7
5 - Borgosesia	81,7	82,5	1,0	30,6	34,1	11,4	83,8	86,4	48,5	48,1
6 - Biella	184,8	201,2	8,9	83,9	89,5	6,7	90,3	90,6	50,3	48,9
7 - Novara	258,4	291,9	11,3	88,6	105,2	18,7	80,0	84,9	45,9	41,6
8 - Verbania	201,0	228,0	13,4	74,7	85,3	14,2	87,7	89,6	44,0	43,0
9 - Cuneo	139,9	145,3	3,9	33,6	40,3	19,9	56,5	65,2	44,4	43,3
10- Saluzzo-Savigliano-Fossano	137,1	141,8	3,4	27,9	33,7	20,8	50,6	59,7	43,5	43,0
11- Alba-Bra	128,0	135,5	5,8	27,1	34,6	27,7	51,8	65,1	44,1	43,7
12- Mondovì	97,4	97,9	0,5	19,9	24,4	22,6	50,8	61,0	43,8	42,6
13- Asti	198,8	204,8	3,0	43,0	52,2	21,4	54,7	62,5	45,9	44,9
14- Alessandria	394,9	417,5	5,7	112,9	132,7	17,5	68,2	76,1	42,9	42,2
15- Casale Monferrato	108,0	108,0	-	25,3	30,3	19,7	58,5	65,5	45,3	44,3
Totale	4.052,0	4.491,0	10,8	1.414,9	1.634,5	15,5	78,1	82,7	45,1	44,3

Cercle	Total population		Perct. Change 1962-'70	Number of non agricultural workers		Perct. Change 1962-'70	Perct. of non agricult. active population		Perct. of active popul. on total pop.	
	1962	1970		(62)	(70)		1962	1970	1962	1970
1 - Tezpur	1,755.7	2,044.7	16.1	745.7	944.9	13.8	70.0	71.1	44.9	44.1
2 - Jorhat	(04).4	(44.3	23.8	(40.2	(50.2	24.9	70.2	81.0	47.4	46.0
3 - Mokokchung	(13.2	(58.2	9.7	37.4	38.8	23.8	71.1	77.1	45.0	44.4
4 - Wokha(II)	(84.8	(12.8	8.7	(0.7	38.8	13.5	62.2	(70.8	43.4	44.7
5 - Darrang	81.1	92.2	1.9	20.8	24.2	11.4	83.8	86.4	44.5	46.1
6 - Dhalla	(68.8	(20.2	8.4	84.9	84.2	8.7	90.1	90.4	50.1	46.8
7 - Diphu	238.8	272.0	13.7	88.8	102.8	16.7	80.0	84.9	45.9	41.6
8 - Golaghat	(01.2	(28.8	14.4	73.7	85.1	14.2	87.1	90.4	44.0	43.0
9 - Lakhimpur	(35.2	(69.1	8.4	34.8	40.1	14.4	75.2	80.2	46.4	42.4
10- Sibsagar-Nowgaon Pooram	108.1	(41.8	7.4	47.2	51.7	20.8	50.6	59.1	43.5	43.0
11- Lido-Mon	134.6	158.8	8.8	47.1	54.8	21.7	71.8	85.1	44.1	41.7
12- Amguri	87.4	97.4	6.8	19.4	24.4	45.8	70.4	82.0	43.4	42.4
13- Aos	(48.2	204.8	7.0	44.8	54.2	21.4	74.1	86.2	45.9	44.4
14- Kiphire(II)	194.0	417.4	4.7	113.8	(12.2	17.5	84.1	76.1	41.4	42.2
15- Tuensang Headquarters	104.0	134.8	-	28.1	37.1	14.7	34.2	46.4	45.1	44.1
Total	4,823.2	6,191.2	18.4	1,814.8	1,914.8	15.5	78.1	82.1	46.1	44.1