New Firm Location: An Equilibrium Model and its Disequilibrium Dynamics

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ABSTRACT. This paper is centered on two basic statements: i) the birth of new firms is spatially related to location factors endowment and ii) the set of location factors can support only up to a given number of firms.

The paper firstly defines the regional ex-ante demand for firms as a function of location factors set. In the following step a definition of regional equilibrium stock of firms is given and a static equilibrium model of new firms birth is built up. In a dynamic disequilibrium model the net birth of firms is a function of two disequilibrium terms: a sectoral and a regional one.

The sectoral disequilibrium depends on the industry production structure, the regional disequilibrium is linked to the adaptation elasticity of location factors set to an exogenous shock.

Finally, a first estimation on Italian data is performed, on the basis of which some new lines of analysis are suggested.

1. Introduction

The research concerning entrepreneurial dynamics have experienced an increasing interest over the last decades, with reference both to development issues, and to labour market (Burns and Dewhurst, 1986; Storey et al., 1987; Richerche and Studi, 1989).

The growing attention paid by scholars to local endogenous development has contributed to diffuse theoretical and empirical studies on small firms and, particularly, on new firms (Storey, 1982; Reid and Jacobsen, 1988; Burns and Dewhurst, 1989).

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A further and more specific motivation has been found in the Italian case: the availability of several data bases — not previously explored for studying purposes (CERVED, ASPO, INPS) — containing a great deal of information about new firms.

All that has allowed researchers to better evaluate the extent and significance of the new firms phenomenon and, moreover, to start studying systematically the different factors underlying the start-up process.

This attention has been paid with the aim of explaining the sectoral factors at the origin of the new firms formation, as well as the strong spatial (and sectoral) heterogeneity in natality rates.

The convergence of the above mentioned different interests has largely contributed to the flowering of economic analysis relating to the vitality of new firms (Ricerche and Studi, 1989; Mariti, 1990; Mussati, 1990).

The idea of connecting the new firms birth with location models hasn't so far received satisfying attention. On one side there are few studies about the spatial dispersion of location factors; on the other, a number of multiregression models can be found where observed location of firms, or new firms, is related to factors endowment within theoretically weak models.

The present paper tries to establish explicit linkages between location models and new firms (net) birth. Particularly the FLEUR model (Molle, 1983; Ancot, Kuiper, and Paelinck, 1983; Girardi and Paelinck, 1991) has been used to study the firms birth phenomenon first in a static and second in a dynamic theoretical framework. The analysis has stopped just before the empirical implementation of the model, because of the lack of complete estimates of the location factors set; this extension represents a possible further research step.

Nevertheless, conclusions obtained seem to

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provide useful insights in the new firms birth dynamics, which is seen as a spatially differentiated phenomenon.

The logical scheme of the analysis may be summarized as follow. It started with defining location elasticities, which are one of the operational tools for observing spatial changes in a defined time period (Kuiper, 1983; Kuiper and Paelinck, 1983). The stock of operating firms — at time **t**, in sector **i**, in region **r** — may be viewed as the result of the underlying location factors set, a region **r** is endowed with. It may also be seen as the effect of exogenous shocks affecting the sector **i** at the more general national or international level.

Along this way the firms stock equilibrium has been defined as a function of location factors and sectoral firms stock. A first result of the study has been the attainment of an equilibrium model connecting the location elasticity of firm births to the regional firms share for sector **i**. The elasticity has been defined as the ratio between the change rate of new firms natality — at time **t**, in sector **i** in region **r** — and the same natality rate for the overall sector **i**.

A further step in the analysis has been the shift from a static towards a dynamic framework. The observed number of net births in time lag **(t − 1, t)** depends on two terms: the difference between the observed firms number and the equilibrium stock, and the difference between observed births and the equilibrium.

In this way the central point of the work has been focused: net births of new firms are equal to the equilibrium elasticity of observed births plus a disequilibrium term. This second term is quite crucial and may be split into two different components: a sectoral and a regional one.

2. A theoretical model of new firms location

The concepts introduced in the previous section can be formalized by a definition of the ex-ante demand for firms. The ex-ante demand — for sector **i** in region **r** — can be seen as the number of firms which would locate in an efficient way in region **r** according to the location factors endowment in the region. A functional definition of the ex-ante demand for firms can't be given as it foregoes the firms location and it is thus not observable; however, it is possible to postulate that such a potential demand will be positively related to the endowment of locational factors for sector **i**. So one can derive a probability p_{ir} (Ancot, Kuiper and Paelinck, 1983) that a region **r** has a demand of firms of sector **i** as:

$$p_{ir} = \frac{1}{1 + e^{-a_i' x_r - a_i}} \tag{2.1}$$

where x_r is the vector of location factors in region **r** and a_i' and a_i are specific constants for sector **i**; function (2.1) is a well know "logistic" function, its graph is shown in Figure 1.

Three different cases can then arise.

- $a_i' x_r < a_i' x_{r_1}$: an increase in the location factors set would not lead to a significant increase of the probability of an actual demand for firms. x_{r_1} can be regarded as a minimum threshold under which the probability that the region **r** has a demand is extremely low.
- $a_i' x_{r_1} < a_i' x_r < a_i' x_{r_2}$: the increase of the probability is more or less proportional to the aggregate increase in the location factors set.
- $a_i' x_r > a_i' x_{r_2}$: a slight increase of probability, will again correspond to a location factors increase. Actually each location factors can be considered here as subject to the law of decreasing marginal products: in this time period the probability of a demand tends to a saturation level, because of congestion diseconomies.

It is now possible to define the supply of firms as the firms share of sector **i** in region **r** at time **t**. The existence of an equilibrium regional share of sector **i**, proportional to the probability of ex-ante demand, can be postulated as follow:

$$\frac{y_{ir}^{\circ}}{y_{i.}} = c_i^{\circ} p_{ir} \tag{2.2}$$

where c_i° is a proportionality constant. By substitution from (2.1):

$$\frac{y_{ir}^{\circ}}{y_{i.}} = \frac{c_i^{\circ}}{1 + e^{-g_{ir}}} \tag{2.3}$$

where:

y_{ir}° is the equilibrium value of sector **i** firm location in region **r**,

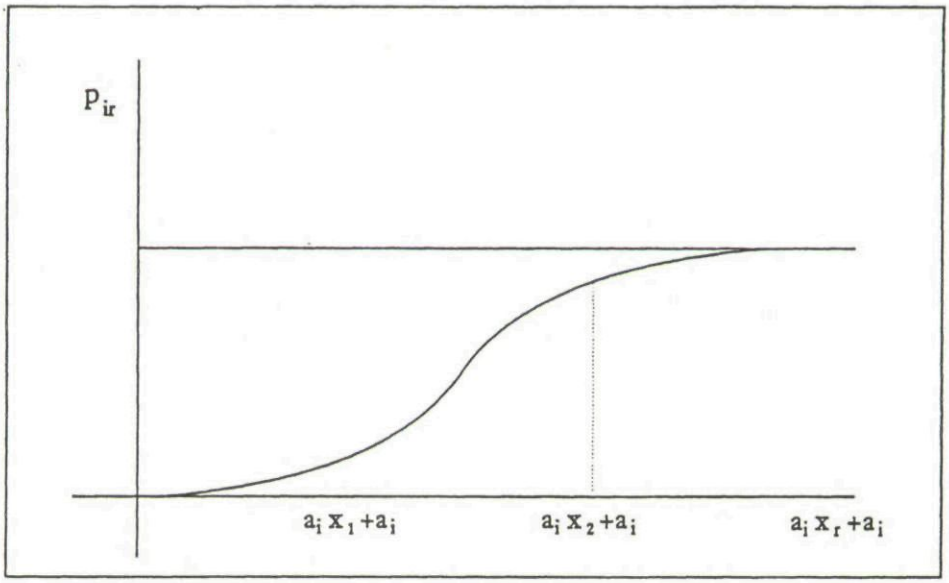

Fig. 1. The ex-ante demand for firms.

$y_i \triangleq \sum_{r=1}^{R} y_{ir}$ is the total of firms in sector **i**, and

$g_{ir} = a_i' x_r + a_i$ is the location factors vector.

If it has been postulated that the firms location within a region is a function of location factors, it is also necessary to take into account that regional location is subject to exogenous variables too. In order to estimate the effects of possible sectoral changes, the equilibrium relation (2.3) can be manipulated as follow (Kuiper and Paelink, 1983):

$$\frac{y_{ir}^{\circ}}{y_{i.}} = \frac{c_i^{\circ}}{1 + y_{i.}^{-1} e^{-g_{ir}}} \tag{2.4}$$

and finally:

$$y_{ir}^{\circ} = \frac{c_i^{\circ} y_{i.}}{1 + y_{i.}^{-1} e^{-g_{ir}}} \tag{2.5}$$

The equilibrium firms stock in sector **i** can be defined as a function of specific regional location factors and the existing sectoral firms stock.

2.1. *The static equilibrium model of new firms, an elasticity approach*

The net equilibrium firms birth within a region can be seen as a variation in the equilibrium stock of firms. It is interesting to observe how a change in independent variables of relation (2.5) will affect the equilibrium stock of firms. Under the assumption that instantaneous variations in the location factors are equal to zero — this hypothesis has been empirically tested in Molle (1983) — it is possible to derive an equilibrium location function for new firms:

$$\frac{\partial y_{ir}^{\circ}}{\partial y_{i.}} = \frac{2 y_{ir}^{\circ}}{y_{i.}} - \frac{y_{ir}^{\circ 2}}{c_i^{\circ} y_{i.}^2} \tag{2.6}$$

Relation (2.6) can be rendered in term of the location elasticity: let us call y_{ir} the existing firms stock — at time **t**, in sector **i**, in region **r** — and $y_{i.}$ the firms stock in sector **i** in the whole reference area at the same time $y_{i.} = \Sigma\, y_{ir}$.

It is useful to define sectoral location elasticity as a measure of the relative change in the firm dotation of an area (see 2.8).

It is so possible to put:

$$E_{iri.}^{\circ} = 2 - \frac{1}{c_i^{\circ}}\, s_{ir}^{\circ} \tag{2.7}$$

where:

$$E^{\circ}_{iri.} \triangleq \frac{\frac{\delta y^{\circ}_{ir}}{y^{\circ}_{ir}}}{\frac{\delta y_{i.}}{y_{i.}}} \qquad (2.8)$$

is the sectoral location elasticity of new firms of sector **i** in region **r** and $s^{\circ}_{ir} \triangleq y^{\circ}_{ir} y^{-1}_{i.}$ is the equilibrium share of firms in region **r**. As elasticity is defined as the ratio of two relative variation rates, $E^{\circ}_{iri.}$ represents the variation of the equilibrium birth rate of sector **i** in region **r**. It will follow from a variation of the birth rate of sector **i** as a whole. From the addictivity property of elasticity it is easy to derive that:

$$c^{\circ}_{i} = \sum_{r=1}^{R} \left(\frac{y^{\circ}_{ir}}{y_{i.}} \right)^2, \text{with } \frac{1}{R} < c^{\circ}_{i} \leqslant 1 \qquad (2.9)$$

So function (2.7) is a monotonously decreasing function whose parameter is the sum of squared regional equilibrium shares. From the graph (see Figure 2) of the equilibrium relation, it is useful to point out some of the futures of the new firms equilibrium location.

i) The intercept equal to 2 show that, for a low share of firms, region **r** birth rate will never be more than the double birth rate of sector **i**. Then a high location of new firms of sector **i** in a region **r** with a low firms share will generate location disequilibria.
ii) The negative slope means that the smaller the number of firms located in region **r** is, the higher will be the birth of firms following from a variation of firms number at sectoral level.
iii) The limits of the parameter c°_{i} are 1, all the firms of sector **i** are located in one region and $1/R$, the firms of sector **i** are equally spread over the **r** regions. In every intermediate situation, for an equal regional share of firms, the equilibrium elasticity of birth will be more or less high according to the sector **i** concentration in a smaller number of regions.

2.2. *A dynamic disequilibrium model*

The static equilibrium relation in the previous paragraph refers to a time period **t** ($y^{\circ}_{ir} \triangleq y^{\circ}_{irt}$). Yet the number of observed firms y_{irt}, and consequentially the birth of firms Δy_{irt}, do not necessarily coincide with the equilibrium value. It is therefore

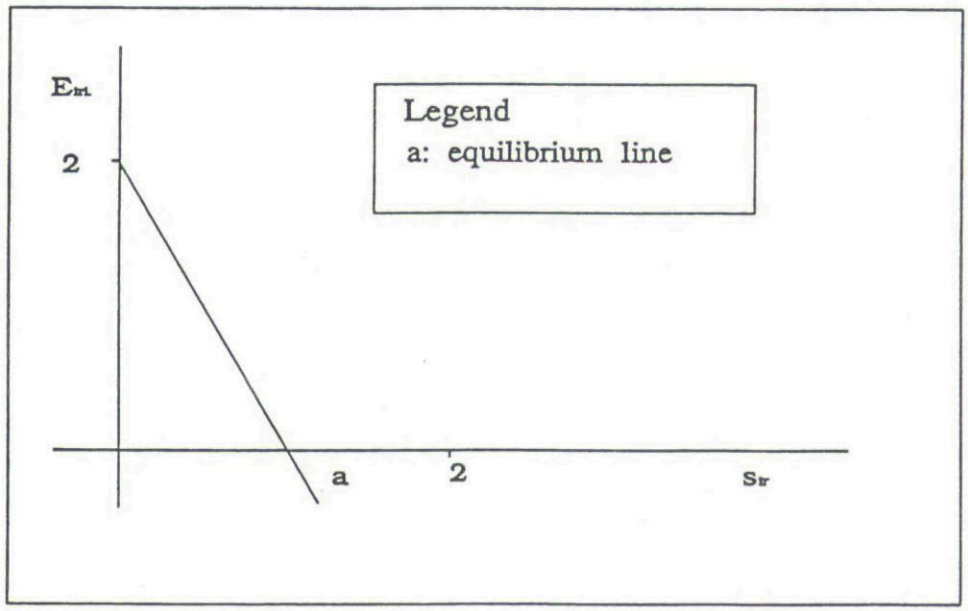

Fig. 2. Equilibrium line of new firms location.

suitable to define the birth of observed firms by the following dynamic relation:

$$y_{irt} - y_{ir,t-1} = \alpha_i(y^\circ_{irt} - y_{irt}) + \frac{\alpha_i}{2}[(y^\circ_{irt} - y^\circ_{ir,t-1}) - (y_{irt} - y_{ir,t-1})] \quad (2.10)$$

where:

$y_{irt} - y_{ir,t-1}$ the number of observed births between time period **t** and **t − 1** is linked by a linear relation to:
$y^\circ_{irt} - y_{irt}$, the difference between the observed and the equilibrium number of firms and
$[(y^\circ_{irt} - y^\circ_{ir,t-1}) - (y_{irt} - y_{ir,t-1})]$, the difference of observed and equilibrium births.

Defining:

$$\eta_{irt} \triangleq -\ln\left(\frac{c_i y_{i.t}}{y_{irt}} - 1\right) \quad (2.11)$$

relation (2.10) can be rewritten as:

$$\eta_{irt} - \eta_{ir,t-1} = \beta_i(\ln y_{i.,t-1} + g_{ir,t-1} - \eta_{ir,t-1}) + \frac{\beta_i}{2}(\ln y_{i.t} + g_{irt} - \ln y_{i.,t-1} - g_{ir,t-1} - \eta_{irt} + \eta_{ir,t-1}) \quad (2.12)$$

equilibrium value now being, from relation (2.5):

$$\eta^\circ_{irt} \triangleq ln y_{i.} + g_{ir} \quad (2.13)$$

After algebraic manipulation, with the assumption (Girardi R. and J. H. Paelinck, 1991) that $\eta_{irt} - \eta_{irt-1}$ can be approximated by $\delta\eta_{irt}/\delta t$:

$$E_{irt.,t-1,t} = \left[2 - \frac{y_{ir,t-1}}{c_i y_{i.,t-1}}\right] + \left[\frac{\delta_i}{\rho_{i.}}(-\eta_{ir,t-1} + \overline{ln y_{i.t}} + \overline{g_{irt}}) - 1\right] \times \left(1 - \frac{y_{ir,t-1}}{c_i y_{i.,t-1}}\right) \quad (2.14)$$

where:

$$\delta_i \triangleq \frac{\beta_i}{1 + \frac{\beta_i}{2}} \quad (2.15a)$$

$$\rho_i \triangleq \frac{dy_{i.}}{y_{i.}} = dlny_{i.}:$$

is the birth rate of sector **i** (2.15b)

$$\overline{\ln y_{i.t}} \triangleq \frac{\ln y_{i.t} + \ln y_{i.,t-1}}{2}:$$

is the logarithmic mean of the firms number (2.15c)

$$\overline{g_{ir}} = \frac{g_{irt} - g_{ir,t-1}}{2}: \quad (2.15d)$$

is the logarithmic mean of location factor endowment

From (2.14) it is possible to define:

$$E_{iri.,t,t-1} = E^{\circ\circ}_{iri.,t,t-1} + d_{ir} \quad (2.16)$$

where:

$$E^{\circ\circ}_{iri.,t,t-1} = 2 - \frac{1}{c^\circ_i}\, s_{ir} \quad (2.17a)$$

is defined as equilibrium elasticity of observed births and:

$$d_{ir} = \left[\frac{\delta_i}{\rho_{i.}}(-\eta_{ir,t-1} + \overline{ln y_{i.t}} + \overline{g_{irt}}) - 1\right] \times \left(1 - \frac{y_{ir,t-1}}{c_i y_{i.,t-1}}\right) \quad (2.17b)$$

is the total disequilibrium of birth location.

In Figure 3 the equilibrium birth elasticity (relation 2.8) and the observed equilibrium birth elasticity lines are presented.

The two lines differ because s_{ir} (the share of observed firms) are found to be different from s°_{ir} (the equilibrium share of firms).

It is however possible to postulate $E^{\circ\circ}_{iri} \simeq E^\circ_{iri}$. This assumption hasn't been judged too restrictive (see the empirical analysis in section 3). The difference between the two elasticities was found to have a limited influence on the evaluation of the equilibrium parameters.

The disequilibrium term d_{ir} can be split in a sectoral term d^*_i and in a regional one d°_{ir}:

$$d_{ir} = (d^*_{i.} + d^*_{ir})\left(1 - \frac{y_{ir}}{c_i y_{i.}}\right) \quad (2.18)$$

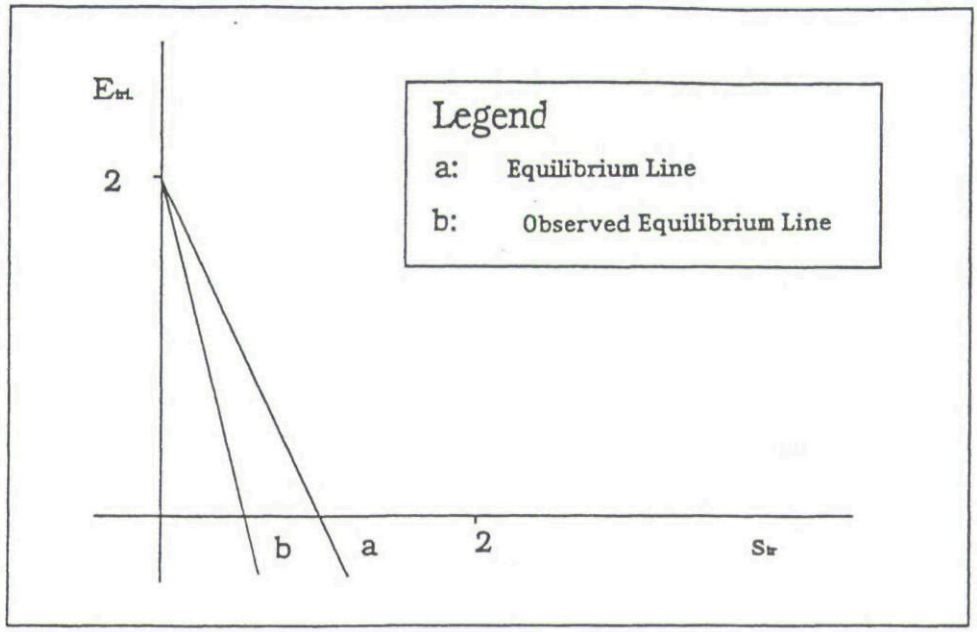

Fig. 3. Equilibrium and observed equilibrium lines.

where:

$$d_{i.}^{*} \triangleq \left(\frac{\delta_i}{\rho_{i.}} \overline{lny_{i.t}} - 1 \right) \tag{2.19a}$$

and

$$d_{ir}^{*} \triangleq \left(\frac{\delta_i}{\rho_{i.}} (\overline{g_{irt}} - \eta_{ir,t-1}) \right). \tag{2.19b}$$

After some manipulations the dynamic disequilibrium relation can be adapted to:

$$E_{iri.} = (2 + d_{i.}^{*}) - \frac{1}{c_i} (1 + d_{i.}^{*}) \frac{y_{ir}}{y_{i.}} + \varepsilon_{ir} \tag{2.20}$$

where

$$\varepsilon_{ir} \triangleq d_{ir}^{*} \left(1 - \frac{y_{ir}}{c_i y_{i.}} \right) \tag{2.21}$$

A graph of relation (2.20) is presented in Figure 4. One can note that:

— in a perfect equilibrium state the birth of firms, in all regions, would be in accordance with the regional location factors endowment, so that all birth elasticities ($E_{iri.t-1,t}$) would be distributed on line **a**.

— However, the presence of two disequilibrium terms tends to shift the disequilibrium of births from the equilibrium line. The first term, sectoral term d_i^{*}, is shared by all regions, it is a function of:

i) β_i: the parameter of the dynamic relation;
ii) ρ_i: the birth rate of sector **i**;
iii) $\overline{\ln y_i}$: the logarithmic mean of the number of firms of sector **i**.

In presence of a sectoral disequilibrium, line **a** would be shifted and rotated towards line **b** or **c**, according to the sign of d_i^{*}: location elasticities will be major of equilibrium ones in some regions and minor in other.

— Finally a region "will be found" on one of the lines, only if $\varepsilon_{ir} = 0$, which is possible only in the following three cases:

i) the adaption parameter β_i is equal to 0, which means there is perfect stationarity;
ii) $g_{irt} - g_{ir,t-1} = 2lny_{i.,t-1}$;
iii) $s_{ir} = 1 \vee s_{ir} = 1/R, \forall r$.

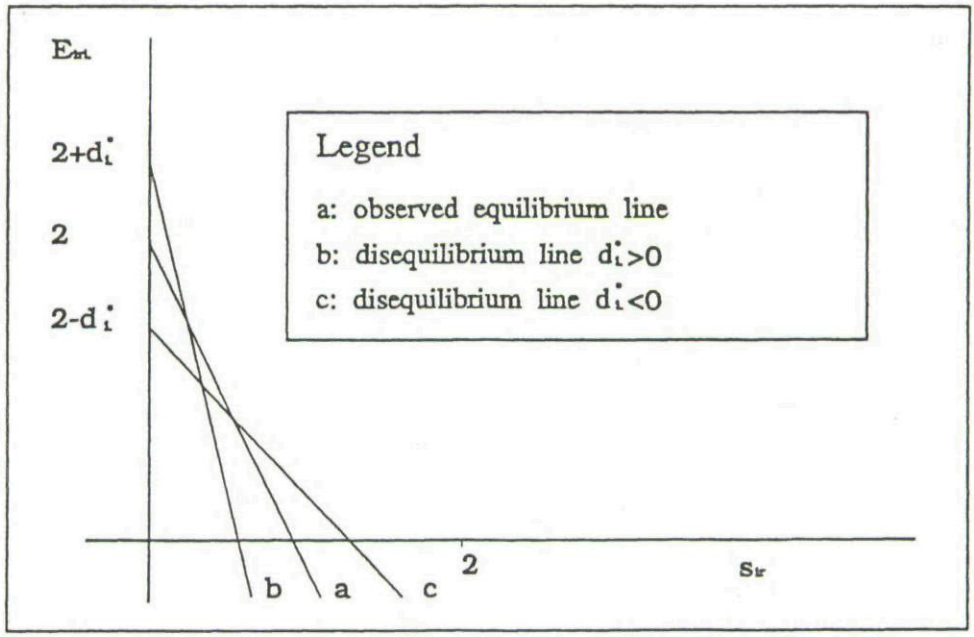

Fig. 4. Equilibrium and disequilibrium lines of new firms location.

In the next section the results of a first estimation of the models are given, but a previous summary of the theoretical issues seems to be useful.

First the static equilibrium model gives the extent of the firms birth which would occur in a region as a reaction to a sectoral exogenous variations (the only one which is possible in the static environment). The equilibrium relation points out that the smaller the number of firms located in a region is, the higher the firms birth linked to an exogenous variation will be.

Second the dynamic model showed how the firms birth could be affected by two kinds of disequilibria.

The first disequilibrium situation will be experienced in all regions because of its sectoral character, assuming that a high number of operating firms correspond to a low threshold of entry. The sectoral disequilibrium birth of firms will depend on sector **i** structure: the lower the threshold is, the higher will be the chance to observe a sectoral disequilibrium. Actually, the sector will be quite dynamic and therefore far from a static equilibrium.

The second, regional disequilibrium, is mainly linked to the adaptation of regional location factors set to the changes occurred in the previous period. It is also connected to the reaction rate of the supply of firms to demand modifications. Both can be considered as characteristics of regions with high firms shares in sector **i**. First because location factors adaption will be easier for a rich endowment than for a poor one, the poor one being surely more rigid. Second because if a region has a high share of sector **i** the know-how of the sector will be high and consequently the birth of firms will be more efficient.

If a region has a high firms share, then it can be assumed that it is specialized for this sector. Thus it would be more difficult to start up a new firm. Even if one firm starts up, it has to be more efficient than a firm born in a low-share region. So regional disequilibrium births will be more in low share regions than in high ones.

3. A first estimation on Italian data

Many scholars suggested that the strong "heterogeneity" (Mussati, 1990; Contini and Revelli, 1992), experienced by birth rates and turnover in new firms cohorts, asks for the existence of a

"threshold S" under which no relevant barriers to entry, or exit, are to be found (Vivarelli, 1990; Arrighetti, 1992).

So several marginal productors, which operate for trial and errors, are found on the market.

The average life duration of such enterprises is quite short because of a rather high death probability, and the turbulence of the "economic space" is, as a consequence, comprehensively high.

Above the "threshold S" it exists a more steady set of firms which tend to assess themselves around one or more optimum size. They last, on average, longer than marginal firms.

In order to eliminate at least partially the turbulence under the "threshold S", only "companies" have been taken into consideration. They are one of the three groups in which CERVED split the data base on the firms stock.

The explicit assumption is that "companies" would be, on average, longer lasting than "individual firms" or "family business firms" and that at the start up of those firms is recognizable a greater "willingness" involving a greater stability.

The spatial reference has been chosen in the Northern area — 35 out of 41 provinces have been examined (all those for which the entire time set data were available). The time set analyzed starts at the first semester 1986 and ends at the second semester 1990.

Once decided to refer to "companies", the sectoral choice has been to some extent imposed to the one digit disaggregation, as the two digits choice would have involved many empty cells in the matrix sector/province, particularly in the analysis of semestral variation.

This paper doesn't aim at a detailed analysis of starting data but it suitably underlines that absolute numbers are quite relevant. The operating firms stock, for the whole sectors and the entire area, was about 161 thousand of companies at the end of 1985.

The models have been estimated for 10 economic activities sectors. Birth elasticities and the sectoral shares of firms have been computed using the following formulas (NF = Number of Firms):

$$E_{iri.t,t-1} = \frac{\ln NF_{irt} - \ln NF_{ir,t-1}}{\ln NF_{i.t} - \ln NF_{i.,t-1}} \triangleq \frac{\Delta \ln NF_{irt}}{\Delta \ln NF_{i.t}} \qquad (3.1)$$

$$s_{irt} = \frac{\mathrm{NF}_{\mathrm{irt}}}{NF_{i.t}} \qquad (3.2)$$

3.1. *Modelling*

The dynamic model has been estimated for each semester, and two specifications have been tested:

$$E_{iri.t-1,t} = 2 - \frac{1}{c_i} s_{ir} + \varepsilon \qquad (3.3)$$

$$E_{iri.t-1,t} = (2 + d_{i.}) - \frac{1}{c_i} (1 + d_{i.}) s_{ir} + \gamma_{ir} + \varepsilon \qquad (3.4)$$

The following tests have been selected for the simple regression model:

$$E_{iri.} = \alpha - \beta s_{ir} + \varepsilon \qquad (3.5)$$

TEST 1: H_0: $\hat{\alpha} = 2$

TEST 2: H_0: $\hat{\beta} = \dfrac{1}{\sum_{r=1}^{R} \left(\dfrac{y_{ir}}{y_{i.}} \right)^2}$

The residuals are the sum of the regional disequilibrium term and a classical random variable and then stochastic variables. As under (3.4):

$$\alpha = 2 + d_i^*. \qquad (3.8)$$

$$\beta = -(1 + d_i^*) \frac{1}{c_i} \qquad (3.9)$$

the following test has been performed:

TEST 3: $\hat{\alpha} = 1 - \dfrac{1}{\hat{c}_i} \beta$

In order to simplify the presentation only the results of the 5 most significant sectors are presented: Agriculture (Table I), the three Industrial sectors — Chemicals, Mechanics, Food & Textiles — (Table II, III, IV) and Banking & Producer Services (Table V). The further tables show the results of estimations. The following notations must be made:

- positive result of test with 95% confidence interval: "underline";
- positive result of test with 99% confidence interval: "**bold**";
- for the dynamic model test:

(**) notes a negative result, otherwise
(..) notes the interval in which the population parameters are included; it reveals the presence of a significant sectoral disequilibrium.

TABLE I
Agriculture — (Sector 0)

Sem.	$\hat{\alpha}$	$\hat{\beta}$	r^2	$\hat{\alpha} = 1 - (1/\hat{c}_i)\hat{\beta}$
1986.2	**1.19**	− 3.86	0.004	(**)
1987.1	1.16	**− 2.91**	0.003	(**)
1987.2	1.55	−10.41	0.022	(**)
1988.1	1.44	− 8.41	0.014	(**)
1988.2	1.98	−19.57	0.058	(**)
1989.1	1.47	− 9.32	0.011	(**)
1989.2	0.15	7.19	0.002	(**)
1990.1	1.82	11.38	0.002	(**)
1990.2	0.69	−14.17	0.004	(**)

TABLE II
Chemicals — (Sector 2)

Sem.	$\hat{\alpha}$	$\hat{\beta}$	r^2	$\hat{\alpha} = 1 - (1/\hat{c}_i)\hat{\beta}$
1986.2	1.89	− 6.17	0.034	(**)
1987.1	1.06	− 0.37	0.000	(−0.57, 0.45)
1987.2	1.61	− 4.34	0.022	(**)
1988.1	1.26	− 1.90	0.009	(−0.68, 0.16)
1988.2	1.62	− 4.42	0.005	(−1.88, −1.66)
1989.1	1.86	− 6.36	0.018	(**)
1989.2	1.02	− 2.71	0.000	(−1.93, 1.43)
1990.1	1.15	− 1.01	0.001	(−0.69, 0.18)
1990.2	0.35	−17.70	0.041	(**)

TABLE III
Mechanical Industry — (Sector 3)

Sem.	$\hat{\alpha}$	$\hat{\beta}$	r^2	$\hat{\alpha} = 1 - (1/\hat{c}_i)\hat{\beta}$
1986.2	1.37	−2.39	0.015	(**)
1987.1	1.39	−2.57	0.044	(**)
1987.2	1.31	**−2.08**	0.262	(**)
1988.1	1.16	−1.07	0.009	(**)
1988.2	1.71	−4.88	0.024	(**)
1989.1	1.15	−1.06	0.003	(**)
1989.2	1.66	−4.76	0.048	(**)
1990.1	1.32	**−2.32**	0.034	(−0.57, 0.13)
1990.2	1.64	−4.78	0.034	(**)

TABLE IV
Food & Textile Industry — (Sector 4)

Sem.	$\hat{\alpha}$	$\hat{\beta}$	r^2	$\hat{\alpha} = 1 - (1/\hat{c}_i)\hat{\beta}$
1986.2	1.16	**−1.18**	0.004	(**)
1987.1	1.18	−1.43	0.014	(**)
1987.2	**1.29**	−2.39	0.022	(**)
1988.1	1.31	**−2.59**	0.025	(**)
1988.2	1.44	**−3.07**	0.016	(**)
1989.1	1.44	−3.73	0.031	(**)
1989.2	1.16	**−1.33**	0.003	(−0.63, −0.40)
1990.1	1.24	−2.08	0.018	(**)
1990.2	1.03	−0.15	0.000	(−0.64, 0.68)

TABLE V
Banking & Producer Services — (Sector 9)

Sem.	$\hat{\alpha}$	$\hat{\beta}$	r^2	$\hat{\alpha} = 1 - (1/\hat{c}_i)\hat{\beta}$
1986.2	1.59	− 5.34	0.049	(**)
1987.1	1.75	− 6.71	0.035	(**)
1987.2	1.32	− 2.86	0.016	(**)
1988.1	1.52	− 5.02	0.038	(**)
1988.2	**2.79**	−10.67	0.053	(**)
1989.1	1.14	**− 1.30**	0.003	(**)
1989.2	1.54	− 5.55	0.028	(**)
1990.1	0.99	**− 0.12**	0.000	(−0.45, 0.46)
1990.2	1.15	− 1.45	0.003	(−0.63, −0.59)

One can observe that the test on the parameters has been founded successful in the most of the cases. Less positive are the results for intercept, which seems to be closer to 1 than to 2. The very low value of r^2 indicate high location disequilibria, which were expected. Actually if one takes into consideration conditions necessary for the lack of location disequilibria it is easy to note that they aren't satisfied:

i) for all provinces in Northern Italy, through the whole period, high birth rates of firms have been observed, involving a general increase of the firms number: stationarity condition **[i]** on page 108 won't satisfied;
ii) no sector has been closed to a complete concentration or an equal distribution over the 35 provinces (condition **[iii]** on page 108);
iii) finally condition **[ii]** on page 108 identifies the

equilibrium variation of location factors, condition which is not satisfied in all provinces.

Anyway it is interesting to observe that conditions **[i]** and **[iii]** are certainly not satisfied: if parameters are significative a province will have an equilibrium location rate for new firms only if the changing of location factors is itself in equilibrium; if not, a province will have an exceeding or defecting location elasticity.

The last assumption, of excess or defect in the new firms location, is presented in the next paragraph. It can be a suggested interpretation tool, which future analysis will have to test with more accuracy.

With regard to the presence of sectoral disequilibria, results in TEST 3 point out that only the chemical sector seems to experience a systematic sectoral disequilibrium. Nevertheless it must be observed that even in presence of a sectoral disequilibrium the parameter was found to be significative (positive TEST 2). This seems to allow the hypothesis that the translation and rotation of the equilibrium line due to sectoral disequilibria are limited, so the disequilibrium induced by sectoral variables seems to be clearly lower than the above mentioned provincial disequilibria.

4. Residuals analysis and further research lines

As a final step of the analysis some first interpretations of regression residuals can be suggested. Residuals measure the distance between the observed points and the regression line (in the simplest case, that one reproduced in Figure 2). A positive residuals value involves that the observed supply of firms is greater than the potential demand — the opposite will be for residual negative values.

This exceeding supply may indicate a situation of over-utilisation of the specific location factors set; a possible consequence may be the impoverishment of the factors set. In the medium term all this, in turn, may involve a filtering down process for the existing, or at least potential, new firms.

The underlying idea is that new firms birth i) is highly related to location factors endowment for the specific region, and ii) any factors set can support a maximum number of firms. Any set has to be therefore renewed and enriched, otherwise it will be exhausted by new firms birth.

This idea is quite relevant for policy making if one observe that i) location factors set doesn't reproduce endogenously and automatically, but has to be enforced from outside with suitable policies, and ii) location factors set is more and more characterised by invisible assets which are frequently "public goods" and, for this reason, are no longer efficiently offered through market competition.

So it can be expected that regions showing a systematic over-utilisation of their specific location factors set may experience shortages and bottlenecks in their future development, not being able to improve and enrich the specific infrastructures and invisible assets offered to new potential firms.

In the present research some interpretations along this way are sketched. The following three figures report the values of normalised residuals for each of the three manufacturing sectors (Chemicals, Mechanics, Food and Textile) together with percentage shares of sectoral dotation (at 1990).

It is not surprising to note that elasticities corresponding to very low shares of dotations show very high scores and, roughly speaking, a greater instability in values. A broader dispersion of residuals related to low values of sectoral shares can consequently be noticed.

Before passing to the results outlined in the three figures it's worthwhile pointing out that Milan represents a systematic outlier, since it holds shares higher than 30% in all the three branches considered. For this reason Milan, attaining to standardised residuals close to the average (zero value), won't be considered.

The widespread dispersion of results leads to consider only few cases. A central values band in which standardised residuals are included between −0.5 and +0.5 (an interval equal to variance) won't be taken into account. The provinces falling within this interval are not too far from average.

Moreover further attention has been paid towards those ones which show the highest share in the different branches analysed. It is possible to stress six different groups of provinces. In Figure 5 — as far as chemical productions are concerned —

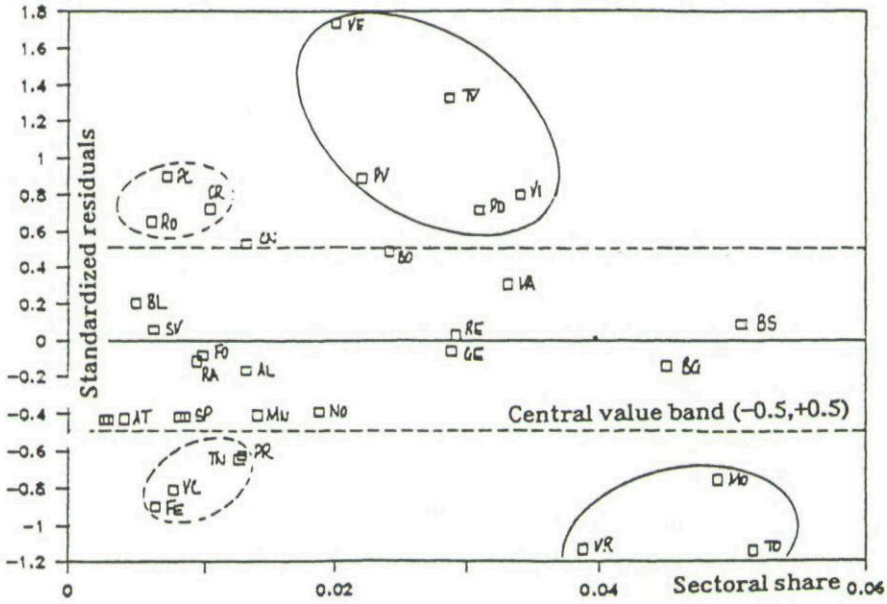

Fig. 5. Sector 2: standardized residuals and sectoral percentage shares.

a set of Veneto's provinces can be recognized — Venice, Treviso, Vicenza and Padoa — with the adding of Pavia too, with positive residuals: that means an exceeding observed supply (with respect to potential demand). Within mechanical productions — Figure 6 — every cluster is formed by only one province: Brescia shows an exceeding supply, while the opposite occurs to Turin. Finally, with regard to food and textile productions — Figure 7 — a set of provinces with positive residuals are

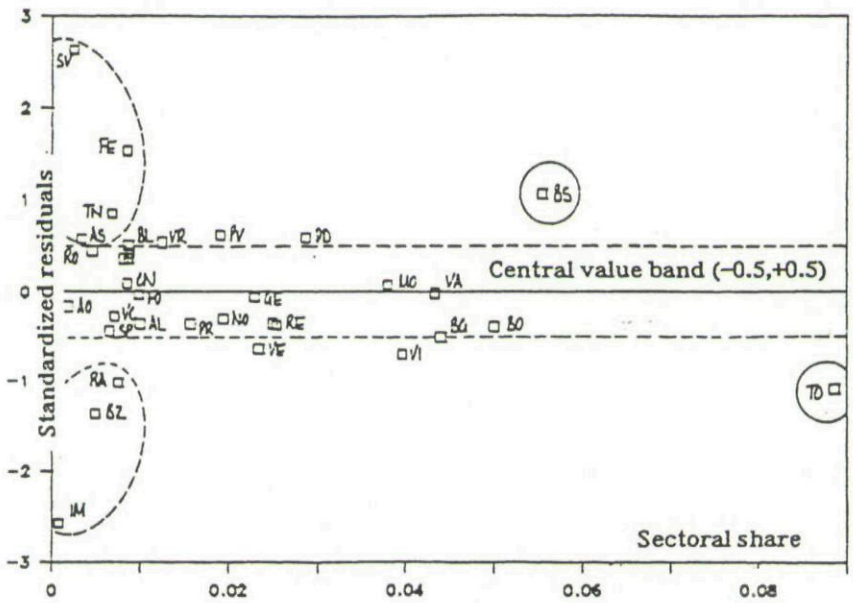

Fig. 6. Sector 3: standardized residuals and sectoral percentage share.

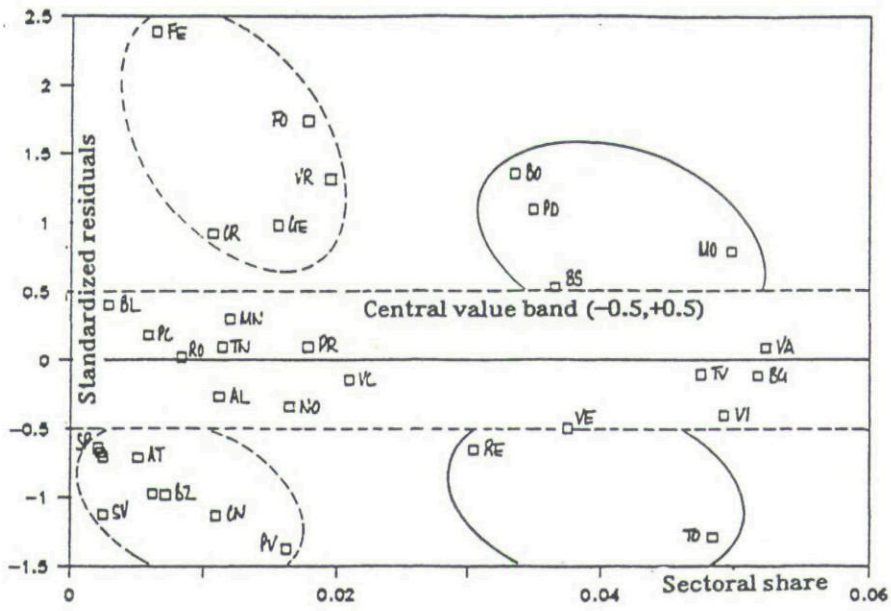

Fig. 7. Sector 4: standardized residuals and sectoral percentage shares.

observed — Bologna, Padoa and Modena — counterbalanced by a couple — Turin and Reggio Emilia — showing an exceeding demand, and therefore over-utilisation of the location factors set.

The most striking result is shown by Turin, always out of the narrow band, in all the three branches, and showing negative values in its standardised residuals. It may be suggested that Turin is affected by a sistematic under-utilisation of its specific location factors set. Therefore it shows a potential growth somehow greater than the one so far realised. Instead, it is possible to underline a creeping but unceasingly worstening of Turin's location factors set, as if that province hasn't been able to implement appropriate policies in revitalising and improving its location factors set.

As for the other provinces, clear cut trends can't be read, although the geographical axis Milan-Venice and Milan-Bologna (and all the provinces within the extreme poles) are showing an over-utilisation of the location factors endowment.

At the moment it is not possible to show definitive evidence but the stressed results seem to be consistent with the model formulation. In particular the presence of very strong regional disequilibria — with a consequent high dispersion of data — seem to be overwhelming with respect to the sectoral disequilibria.

A further step through a full exploration of the residuals involves a complete estimation of the model by the construction of a pertinent location factors set. Along this line it will be possible to quantify area disequilibria in value terms; it will also be possible to underline the proper relation between disequilibrium and the initial endowment of location factors. This final step would be of the highest utility for policy making, offering precise statements about over- or under-utilisation of location factors, here only sketched in a quite impressive way.

In prospecting further developments it's possible to suggest that the suitable area unit will be the province — here considered the smallest significative area for location problems. As far as sectors are concerned, it is preferable a somewhat definition, still to be implemented, of a cluster of three digits NACE-CLIO industries which might show convergence in their demand for specific location factors.

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References

Ancot, J. P. and J. H. P. Paelinck, 1988, 'Peripheriсité: Aspects Theoriques', *Revue d'Economie Régionale et Urbaine* **1**, 50—75.

Ancot, J. P., J. H. Kuiper and J. H. P. Paelinck, 1983, 'The Spatial Econometrics of the European FLEUR Model', in Griffith D. and A. Lea (eds.), *Evolving Geographical Structures*, The Hague: Martinus Nijhoff Publishers.

Arrighetti, A., 1992, *Entrata, dimensione minima ottimale e sopravvivenza dell'impresa*, Paper presented at the Seminar: 'Nascita e start-up delle piccole imprese italiane', 20 February, Milano: Università Bocconi.

Burns, P. and J. Dewhurst, 1986 (eds.), *Small Business in Europe*, London: MacMillan.

Burns, P. and J. Dewhurst, 1989 (eds.), *Small Business and Entrepreneurship*, London: MacMillan Education.

Contini, B. and R. Revelli, 1992, *Eterogeneità, pattern di sviluppo e mortalità infantile delle piccole imprese*, Paper presented at the Seminar: 'Nascita e start-up delle piccole imprese italiane', 20 February, Milano: Università Bocconi.

Garofoli, G., 1990, *New Firm Formation and Local Development: The Italian Experience*, Paper presented at the 30th R.S.A. European Congress, 28—31 August, Instanbul.

Girardi, R. and H. J. P. Paelinck, 1991, *Location Elasticities, FLEUR Model and Disequilibrium. An Application to Italian Data*, Department of Theoretical Spatial Analysis, Rotterdam: Erasmus University.

Kuiper, J. H., 1983, 'Regional Analysis Using Concept of Location Elasticities', *Revue d'Economie Régionale et Urbaine* **3**, 155—172.

Kuiper, J. H. and J. H. P. Paelinck, 1981, 'Macro, Sectoral, Regional Policies and Regional Growth: Some Interrelationships', *Revue d'Economie Régionale et Urbaine* **4**, 202—217.

Kuiper, J. H. and J. H. P. Paelinck, 1983, 'Implémentation empirique d'élasticités de localisation', *Revue d'Economie Régionale et Urbaine* **2**, 15—28.

Mariti, P., 1990 (ed.), *La formazione di nuove imprese*, Milano: F. Angeli.

Molle, W. T. M., 1983, *Industrial Location and Regional Development in the European community: The FLEUR Model*, Aldershot: Gower Publishing Company.

Mussati, G., 1990, (ed.), *Alle origine dell'imprenditorialità. La nascita di nuove imprese: analisi teorica e verifiche empiriche*, Milano: Etas Libri.

Paelinck, J. H. P., 1985, *Eléments d'analyse economique spatiale*, Genéve: Editions Régionales Européennes.

Reid, G. C. and L. R. Jacobsen, 1988, *The small Entrepreneurial Firm.* Aberdeen: Aberdeen University Press.

Ricerche & Studi, 1989, *La creazione di imprese*, Milano: R & S.

Storey, D. J., 1982, *Entrepreneurship and the New Firm*, London: Routledge.

Storey, D. J., K. Keasey, R. Watson and P. Wynarczyk, 1987, *The Performances of Small Firms. Profits, Jobs and Failures*, London: Croom Helm.

Vivarelli, M., 1990, *Natalità e mortalità delle piccole imprese: un modello interpretativo*, L'Industria **12**(3), 467—81.

Vivarelli, M., 1991, 'The Birth of New Enterprises', *Small Business Economics* **3**(3), 215—223.