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## Cross-sectoral effects of retailing firm demographics

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The 42<sup>nd</sup> Congress of the European Regional Science Association  
“From Industry to Advanced Services - Perspectives of European Metropolitan Regions”

Dortmund, August 27-31, 2002

## **CROSS-SECTORAL EFFECTS OF RETAILING FIRM DEMOGRAPHIES**

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### **Abstract**

With regard to the interrelationship between firm births and deaths, Johnson & Parker (1994, 1996) have summarized the various causality relationships into three different effects: what they call the Multiplier, the Competition and the Marshall effects. In this paper, we build an enlarged analytical framework by introducing and discussing (inter)sectoral dimensions. Multiplier and Competition effects are first reassessed according to the degree of sectoral disaggregation. The presentation of a formal monopolistic model (Matsuyama, 1995) that emphasizes the incidence of product variety and elasticities of substitution on relative profits introduces however new analytical results and questions. In particular, the model puts forward potential cross-sectoral effects in terms of entries and exits that correspond to equilibrating processes given profits inequalities, as well as Multiplier effects between products or activities that are close substitutes or Hicks & Allen's complementarity notion (1934) between economic activities. An econometric model that allows for sectoral but also spatial interactions is then specified. Econometric results obtained for Belgium confirm in particular the relevance of an (inter)sectoral setting for research in the interrelationship between firm births and deaths.

**Keywords:** Firm demography; Competition; Multiplier; Sector; Space

**JEL classification:** L00; L13; L81

## Introduction

A large economic literature is concerned by firm births and deaths. A variety of contributions can be articulated around three main research orientations. A first axis is related with industrial economics. It analyses firm demography<sup>1</sup> and focuses on an explanation of the interrelationship between creations and disappearances that rests on the distinction of Multiplier, Competition and Marshall effects (see Johnson & Parker, 1994; Carree, 1997). A second axis, which can be associated with regional economics, is more particularly interested in spatial variations of firm births and deaths rates. These variations are put into relations with territorial organization and resources. Contributions integrate successfully in explanatory econometric models proxies of territories structural and socio-economic characteristics (i.e. a measurement of population or firm densities, human capital indices) (see Reynolds, Storey & Westhead, 1994; Dejardin, 1996, 1999; Spilling, 1996; Kangasharju, 2000). Finally, a third axis can be defined. It takes into account spatial interactions between entrepreneurial phenomena. Applied research appears however embryonic. We found different approaches by simulation (van Wissen, 2000; Brenner, 2001) as well as an empirical research introducing a spatial dimension into its modeling (Florax & Schutjens, 1996).

The present paper could be located at the intersection between the above first and third research axes. Its originality consists in fully integrating sectoral dimension and aggregation into the theoretical discussion of the Multiplier and Competition effects. Thus, after having introduced, on the one hand, the incidence of sectoral (dis)aggregation and, on the other hand, the substitute or complementary quality of products and economic activities that take part in the industrial sector (or in the sectoral sector aggregate), we will be brought to suggest, first, a weighted expression of the Multiplier and Competition effects. Weights will depend closely on the differentiation degree between activities. An outcome will be to propose that the Competition (Multiplier) effect will overcome more probably the Multiplier (Competition) effect since estimations are based on very disaggregated (aggregated) data.

But the discussion could not stop there since variety and substitutability between activities or locations are introduced in a more formal model. That is what we will see through a basic monopolistic competition model due to Matsuyama (1995). Here, relative profits between different groups of industries or locations will depend crucially on product variety and elasticities of substitution. We will be able to explain circumstantially multiplier effects even when activities are very similar or substitutes but also entries and exits under exogenous shocks.

An econometric study is undertaken in order to confront theoretical relations and facts and, eventually, validate modeled relations. As the analysis is interested in located entrepreneurial phenomena, an econometric model cannot ignore the allotopy principle or, in other words, potential spatial interactions. The model has been therefore spatialized. The relative distance between entries and exits potentially determines the intensity of spatial interactions, whatever they may be. The study exploits data that refer to Belgian administrative local level (the “commune”).

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<sup>1</sup> We will use indifferently the terms “demography of firms” or “firm births and deaths” in the following text. Firm demography is however a concept that generally covers a broader reality. Additions are firm growth and firm relocation (migration) (van Dijk & Pellenbarg, 2000; van Wissen, 2000).

The paper is organized as follows. In the following section (section 1), interactions between firm births and deaths are theoretically discussed. In a first sub-section (sub-section 1.1), the contribution of Johnson & Parker (1994) is synthesized. We introduce afterwards a enlarged analytical framework that takes into account sectoral dimensions. This extension is the subject of the second sub-section (sub-section 1.2). The formal monopolistic competition model is presented in sub-section 1.3. The empirical study is exposed in the second section (section 2). We bring the data (sub-section 2.1), the specification of the econometric model that is tested (sub-section 2.2), and the results of estimate (sub-section 2.3). The third and last section is devoted to our conclusions (section 3).

## 1. Theoretical discussion

This section presents a synthesis of the contribution of Johnson & Parker (1994) relating to the interrelationship between firm births and deaths (sub-section 1.1). Their contribution is enlarged by the introduction and the discussion of (inter)sectoral dimensions of firm demography (sub-section 1.2). A model allows to discuss more formally the outcome of product variety and substitution elasticities on relative profits and on multiplier effects (sub-section 1.3).

### 1.1. Interrelationship of firm births and deaths: a temporal analysis

Johnson & Parker (1994) explore the interrelationship between firm births and deaths. What could be the impact of new firms on the number of deaths or on the number of births and that, from a diachronic point of view? Similarly, what occurs with firm births and deaths after some firm deaths? The authors distinguish three different effects: what they call the *Multiplier*, the *Competition* and the *Marshall effects*.

Firm births (during one period) can have positive effects on the number of forthcoming firm creations (or the number of firm creations during following periods), that is *Multiplier effects*. These effects can be, at the origin, directly financial or they can rely on other factors. In this last case, possible demonstration effects can be evoked: the creation of economic activities by others would act favourably on someone's consideration for being entrepreneur him- or herself. With regard to financial flows, we may indicate that new sources of income are potentially at the origin of new expenditures, generating in their turn new activities. In an industry like retailing<sup>2</sup>, the creation of a commercial centre may increase the attractive power on customers from a particular area, it may support the emergence of other trades given new profit opportunities and it may have a positive impact on the maintenance or even the development of existing activities. However, the new commercial centre may also dissuade firm creations. It may also lead some companies to cease their activities given their newly observed non-profitability that would result from an increased supply and a decreased market share, or from the innovation the entering firm introduces on the market and which is capturing customers from the incumbents (*Competition effects*).

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<sup>2</sup> Examples that refer to the retailing industry comes from Johnson & Parker (1994, pp. 283-284). Their empirical applications are incidentally about this sector. We may notice that these authors have applied elsewhere their analytical framework to what seems to be an "all sectors" aggregate (see Johnson & Parker, 1996).

Firm deaths (during one period) can explain the number of subsequent firm deaths (or the number of firm deaths during following periods). We may think about a financial crisis affecting a major company and its diffusion into a particular industry or across industries. It means *Multiplier effects* once again. But firm deaths may also relax competition and give rise to new profit opportunities and new business creations. The authors, with reference to Storey & Jones (1987), argue also that firm deaths could mean the sale of equipment goods at low prices. This would have a positive effect on firm creations by lowering the installation costs.

Impacts of firm deaths on subsequent creations can also be discussed relatively to what they imply in terms of job losses. Unemployment (or its threat) would represent an incentive for an individual to create his or her own enterprise. However, at the aggregate level, high underemployment rates may result from many reasons: an economic recession but, moreover, specific structural, institutional and political factors that would affect negatively the development of economic activities. In this case, profit and creation opportunities may be limited. Entrepreneurship and its attractiveness on individuals proceed from a general context (Johnson, 1986; Storey, 1994; Dejardin, 2000).

The effects known as *Marshall effects*<sup>3</sup> refer to what could be interpreted, at a more disaggregated level, as the firm life cycle: a birth is followed by a death, some years later. Consequently, the number of new firms during a given period will determine the subsequent number of deaths.

Johnson & Parker (1994) have proposed the following table (Table I) to synthesise the Multiplier, the Competition and the Marshall effects which they identify in the interrelationship between firm births and deaths.

Table I. The Multiplier, the Competition and the Marshall effects

	Expected sign of each effect		
	Multiplier	Competition	Marshall
$\partial B_t / \partial B_{t-1}$	+	-	n.a.
$\partial D_t / \partial D_{t-1}$	+	-	n.a.
$\partial B_t / \partial D_{t-1}$	-	+	n.a.
$\partial D_t / \partial B_{t-1}$	-	+	+

B, birth; D, death; n.a., not applicable.

Source: Johnson and Parker (1994).

A quick look at the table leads to notice that Multiplier and Competition effects are relating to the same explanatory variable (firm births or deaths) and have contradictory signs. Thus, as Johnson & Parker emphasise it, an econometric estimate of the interrelationship between births and deaths will be able to report only *net effects*.

<sup>3</sup> “Even for those firms which are successful, death is ultimately inevitable, barring take-over. As Marshall points out in his graphic ‘trees of the forest’ analogy, ‘sooner or later age tells on them all.’ ” (Johnson & Parker, 1994, p. 284, with reference to Marshall, 1920, p. 263).

The authors insist on the temporal dimension within their analysis. The effects of firm creations and firm deaths are subject to a lags structure. This lags structure is however *a priori* undefined and is to be estimated through empirical investigations.

The contribution of Johnson & Parker is almost silent about spatial and (inter)sectoral dimensions relating to firm demography<sup>4</sup>. We try to go beyond these limits in the following sub-sections. Spatial interactions will be taken into account in the econometric model specification (see section 2.2). The (inter)sectoral dimension of firm demography is more particularly discussed. So are the Multiplier and the Competition effects put into relation with the level of sectoral disaggregation and with the substitute or complementary attributes of economic activities.

## 1.2. Interrelationship of firm births and deaths: (inter)sectoral dimensions

This sub-section proposes an enlarged analysis of the interactions between firm births and deaths. The (inter)sectoral dimension is introduced within the Johnson & Parker's framework.

The Multiplier and the Competition effects have already been defined but without any explicit attention to industries that are entering into relationships. Since economic activities are distinguished according to their production and are part of differentiated industrial branches or sectors, the Multiplier and the Competition effects can receive *a priori* different weights that are function of the sectoral disaggregation level. Sectoral disaggregation and consequently homogenisation of activities within each sector that is distinguished would reinforce the Competition effect to the detriment of the Multiplier effect.

The above argument is synthesised in the following expression:

$$NE = \alpha ME + (1-\alpha) CE$$

- where the Net effects (NE) of Multiplier (ME) and Competition (CE) effects with contradictory signs are the results of a weighted sum;
- where the value of  $\alpha$ , between 0 and 1, is a negative function of the level of sectoral disaggregation.

The discussion of the (inter)sectoral dimension of firm demography can still be enriched since elasticities of substitution between activities or locations are introduced in a more formal model. That is the subject of the following section.

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<sup>4</sup> The (inter)sectoral dimension gives rise to a brief illustrated comment that mentions its potential influence on firm births and deaths interrelationship. It is not formally discussed. The spatial treatment of firm demography by these authors confines itself to exploit data attached to administrative entities (the English Counties) of relatively small size. Smallness should give some guarantees about interactions between firm births and deaths to exist. However, there is no reference about distance and weights within interactions.

### 1.3. Formal Modeling

In this section, a basic model is proposed that emphasizes the distinction between competition and multiplier effects across industries according to product differentiation. The formalization is developed by Matsuyama (1995, pp. 713-715). The foundations go back to the monopolistic competition model that was proposed by Dixit and Stiglitz (1977).

There are a lot of differentiated consumption goods in the economy. Suppose they are divided into two groups, 1 and 2. The number of differentiated goods in group  $i$  is denoted  $n_i$ . Suppose moreover that all consumers maximize the same CES preferences:

$$V(X_1, X_2) = \left[ X_1^{\frac{\varepsilon-1}{\varepsilon}} + X_2^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}$$

where  $\varepsilon$  represents the elasticity of substitution between two composite indices  $X_i$ . Composite indices are defined as:

$$X_i = \left[ \int_0^{n_i} [x(z_i)]^{\frac{\sigma-1}{\sigma}} dz_i \right]^{\frac{\sigma}{\sigma-1}}, \quad (\sigma > 1)$$

where variables  $x(z_i)$  are quantities of consumption goods appearing in group  $i$  and  $\sigma$  denotes elasticity of substitution between consumption goods.

There are two types of labor in the economy, managers and workers, which supplies are given and respectively denoted  $M$  and  $L$ . As we turn towards production, we assume for further simplifications that producing quantity  $x$  requires  $x(\sigma-1)/\sigma$  of workers and  $F$  managers. Thus,  $(\sigma-1)/\sigma$  is a constant marginal cost. The quantity of managers needed appears as a fixed cost since it does not depend on  $x$ .

By assumption, there is no unemployment (market clearing conditions are met) for workers as well as managers. It follows that the total number of firms is constant and equal to  $M/F = n_1 + n_2$ .

Profit maximization implies that marginal revenue of the firm equals marginal cost. But we know that marginal revenue may be expressed in terms of the price  $p$  of good  $x$  and the price demand elasticity. In Dixit and Stiglitz model (1977), as each firm neglects the effects of its pricing policy on other firms prices, the perceived elasticity of demand is equal to  $\sigma$ . Thus, assuming moreover that the worker receives a normalized wage  $w$  equals to 1, the price set by each firm is:

$$p(z_i) \left[ \frac{\sigma-1}{\sigma} \right] = w \left[ \frac{\sigma-1}{\sigma} \right] \Rightarrow p(z_i) = 1 \quad \text{for all } z_i \in [0, n_i]$$

It follows that firms are producing at the same scale, that is  $x(z_i) = x_i$ ; and  $X_i$  can now be expressed as:

$$X_i = n_i^{\frac{\sigma}{\sigma-1}} x_i$$

The gross profit (gross of fixed cost  $F$ ) of each firm is then equals to:

$$\pi_i = x_i - \frac{\sigma-1}{\sigma} x_i = \frac{x_i}{\sigma}$$

And each manager in group  $i$  receives:

$$\frac{\pi_i}{F} = \frac{x_i}{\sigma F}$$

A Dixit and Stiglitz price index  $P_i = n_i^{1/(1-\sigma)}$  may be derived for each group  $i$ . It measures the minimum cost for a unit of composite  $X_i$ . By homotheticity of  $V$ , the relative demand  $X_1/X_2$  depends solely on relative price indices:

$$\frac{X_1}{X_2} = \left[ \frac{P_1}{P_2} \right]^{-\varepsilon}$$

It follows that relative gross profits,  $\pi_1/\pi_2$ , can be expressed as a function of the product varieties in each group  $i$ :

$$\frac{\pi_1}{\pi_2} = \frac{x_1}{x_2} = \frac{X_1}{X_2} \left[ \frac{n_1}{n_2} \right]^{\frac{\sigma}{1-\sigma}} = \left[ \frac{P_1}{P_2} \right]^{-\varepsilon} \left[ \frac{n_1}{n_2} \right]^{\frac{\sigma}{1-\sigma}} = \left[ \frac{n_1}{n_2} \right]^{\frac{-\varepsilon}{1-\sigma}} \left[ \frac{n_1}{n_2} \right]^{\frac{\sigma}{1-\sigma}} = \left[ \frac{n_1}{n_2} \right]^{\frac{\varepsilon-\sigma}{\sigma-1}}$$

This is the crucial relation for our discussion. As we can see, its issue depends tightly on the value attached to  $\sigma$  and  $\varepsilon$ . Suppose the intragroup elasticity is greater than the intergroup one ( $\sigma > \varepsilon$ ). Then, profits are negatively related to variety. Matsuyama (1995, p.714) gives also the following illustration: “suppose that group 1 consists of restaurants and group 2 retail stores. A pair of restaurants or a pair of stores are much closer substitutes than dining and shopping (...). If there are too many restaurants and a few stores in the city, restaurants will close down and new stores will open in the long run”. Notice that, if profits between groups are not equal (given some exogenous shock, for example), equalization process will take place through entries and exits of firms. We get here some arguments of cross-sectoral effects of firm entries and exits. That is not all.

Suppose two different locations. Now, we group activities according to them. A given (non informed) consumer could be *a priori* indifferent between locations ( $\sigma < \varepsilon$ ). In that case, profits are positively related to variety in location. “Entry of a new firm, by attracting more customers, would benefit existing firms in the same street. This introduces complementarity in the locational decision, and entry and exit processes lead to all stores clustering into a single location” (Matsuyama, 1995, p.714). What is important is the comparison between elasticities. Even in case of very similar products, such processes may occur. They may be interpreted as Multiplier effects (entries are

followed by entries). The result may also be referred to the Hicks & Allen's notion of complementary goods (1934) with an emphasised reference to economic activities.

Hicks & Allen have advanced the idea according to which the complementarity between goods should be assessed according to market demand and its properties with respect to price variations. For producers of similar goods that are localised in a particular commercial area, the price reduction decided by one of them should imply an increase of his or her market share and, *ceteris paribus*, a decrease of the market share of other producers. Hicks & Allen's complementarity between products can however be suspected since the demand for each producer *increases* rather than *decreases*. The intuition behind Hicks & Allen's complementarity is that, although Competition effects mean sales reductions for producers keeping an unchanged price, the price decrease decided by one of them may also attract new customers in the specific commercial area. The increased demand that follows may well overcompensate, for all producers, the business-stealing effect that results from the initial price reduction. (Matsuyama, 1995)

Relating to the (inter)sectoral study of firm demography, Hicks & Allen's complementarity leads us to reconsider the attractive power of a particular area, with potential cumulative effects from the supply side (goods and services that are proposed) and the demand side (market size).

Moreover, Hicks & Allen's complementarity is not without bringing some difficulties into empirical studies since such complementary activities are likely to appear in sectors where they will commonly be recognised as substitutes. In other words, Hicks & Allen's complementarity may explain Net Multiplier effects in econometric estimates where, given sectoral disaggregation, Net Competition effects would have been reasonably expected.

Given the above theoretical discussion, we could propose that the Competition (Multiplier) effects will overcome more probably the Multiplier (Competition) effects since estimations are based on very disaggregated (aggregated) data. The argument does not take into account formal results about the effects of product variety and substitution elasticities between products on firm entries and exits. According to the proposed formal model, complementarities may occur even between very similar products. With sub-section 1.3, there are now some reasons to anticipate cross-sectoral effects in terms of entries (exits) followed by exits (entries) but also more frequent Multiplier effects than it could be expected at the end of the sole sub-sections 1.1 and 1.2. What are the facts ? That is what the following section 3 proposes to assess.

## **2. Estimation results**

This third section presents the results of an empirical study that may be regarded as first validation tests for the above analytical framework. The study refers to Belgium. The section includes successively: the definition of the data, the specification and the discussion of the econometric model and the presentation of the results.

## 2.1. Data

To assess quantitatively the firm demography is not easy matter to achieve in Belgium, given statistical availability. Nevertheless, if data sets exist<sup>5</sup>, each of them presents some gaps, in terms of continuity and homogeneity of definition, level of geographical and sectoral disaggregation and access (including financial access).

The data used for this empirical study are produced by the Belgian National Institute of Statistics (NIS). They are extracted from the books of the Value-Added Tax authorities. The data include the stock of active taxable self-employed agents or firms at the beginning of each year, the registrations and deletions from the books that occurred during a given year. Our database runs from 1996 to 2000.

An advantage of the provided information is undoubtedly the advanced degree of detail for which it is available. It enables indeed to distinguish 222 sectors for each of the 589 administrative local entities (“communes”) in Belgium. A handicap is its heterogeneity as for, on the one hand, the type of agent (individuals or companies<sup>6</sup>) and, on the other hand, the criterion of geographical localization (abode place or working place for individuals; registered office place or, exceptionally, place at which the VAT is declared for companies<sup>7</sup>). There is a source of errors in measurement that is all the more prejudicial as the geographical unit is of reduced size. Let us note however that it is probable that the abode or the registered office place coincide to a large extent with the working or plant location as regards firm births. This unfortunately could not be checked.

Only part of the whole information was exploited as the study relates exclusively to a selection of retail trades. Thus only 6 sectors were the subject of an econometric research. Sectors were chosen according to nomenclature description. Our special care was to select sectors that are *a priori* bringing together similar economic activities, as the intra-sectoral homogeneity and the inter-sectoral heterogeneity are crucial for the following empirical test. Another concern was to keep sectors that may be qualified as “common”, that means their activity should not rely tightly on special circumstances (idiosyncratic factors). Hotels are probably a good example as we may expect they are mostly located close to tourist places or in major cities. In practice, we chose sectors for which some demographic activity (at least one firm birth or firm death) was registered in a majority of communes.

The six selected sectors are: trade of motor vehicles (NACE 501), repair of motor vehicles (NACE 502), unspecialized retailing trade (NACE 521)<sup>8</sup>, specialized food retailing (NACE 522)<sup>9</sup>, restaurants (NACE 553) and bars and coffee-houses (NACE 554).

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<sup>5</sup> The main providers are the National Institute of Statistics, the VAT Administration, the National Office for Social Security, the National Institute for Social Security for Self-employed people, the Commercial Registers, and private companies as Euro-DB and Gerling Belgium.

<sup>6</sup> There were 689 453 active taxable agents in Belgium in 2000, whom 395 908 were individuals (source: NIS, *General Statistics*, 2001).

<sup>7</sup> Source: interview at the NIS.

<sup>8</sup> This sector may appear heterogeneous as “unspecialized retailing trade” refer to shops selling a large brand of different products. For a large part, however, shops themselves would be substitutes.

<sup>9</sup> This sector is probably the most heterogeneous among the selected sectors. If they represents very common shops, they refer to very different ones as baker’s, butcher’s, fish-shops,...

Before ending this sub-section on the data, let us notice the fact that the statistical series were submitted to a partial rupture in 1998. The NIS had indeed to proceed at that time with the sectoral reclassification of a limited number of activities by using informations resulting from an inquiry among some companies. Some firm stocks, and perhaps some deaths, had to be affected. Notice however that the measures of stocks we used relate to 1996.

## 2.2. Econometric model

The model is extensively described by the following equations and definitions:

$$\begin{aligned}
 NB_{i,00} &= \alpha + \beta_1 RB_{i,9799} + \beta_2 RD_{i,9799} + \beta_3 RBC_{i,9799} \\
 &+ \beta_4 RDC_{i,9799} + \beta_5 RBP_{i,9799} + \beta_6 RDP_{i,9799} \\
 &+ \beta_7 RBPC_{i,9799} + \beta_8 RDPc_{i,9799} + \varepsilon_i
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 ND_{i,00} &= \gamma + \delta_1 RB_{i,9799} + \delta_2 RD_{i,9799} + \delta_3 RBC_{i,9799} \\
 &+ \delta_4 RDC_{i,9799} + \delta_5 RBP_{i,9799} + \delta_6 RDP_{i,9799} \\
 &+ \delta_7 RBPC_{i,9799} + \delta_8 RDPc_{i,9799} + v_i
 \end{aligned} \tag{2}$$

with:

$$RB_{i,9799} = \left[ \sum_t NB_{i,t} \right] / St_{i,96}$$

$$RD_{i,9799} = \left[ \sum_t ND_{i,t} \right] / St_{i,96}$$

$$RBP_{i,9799} = \left[ \sum_{j \neq i} \frac{1}{d_{ij}} \left( \sum_t NB_{j,t} \right) \right] / St_{i,96}$$

$$RDP_{i,9799} = \left[ \sum_{j \neq i} \frac{1}{d_{ij}} \left( \sum_t ND_{j,t} \right) \right] / St_{i,96}$$

where:

- $NB_{i,00}$  and  $ND_{i,00}$  represent respectively the absolute number of firm births and the absolute number of firm deaths during year 2000,
- $NB_{i,t}$  and  $ND_{i,t}$  represent respectively the absolute number of firm births and the absolute number of firm deaths during a year  $t$ , and  $St_{i,96}$  is the stock of active firms at the end of year 1996, relating to the administrative entity  $i$ ;
- $t$  represents the year: 1997, 1998 or 1999;

- $d_{ij}$  is a truncated measure of the Euclidean distance (in meters) separating centroids of administrative entity  $i$  and  $j^{10}$ ; the value of  $d_{ij}$  is zero when  $i$  equals  $j$  or when the distance between centroids is more than 10000 meters;
- $RBc$ ,  $RDC$ ,  $RBPC$ ,  $RDPc$  are defined as the respective complements of  $RB$ ,  $RD$ ,  $RBP$ ,  $RDP$  with respect to the aggregate  $K$ , that is the whole of sectors  $k$ . When  $RB$ , for example, refers to the rate of firm births in sector  $k$ ,  $RBc$  is equal to the rate of firm births in all other sectors except  $k$ .
- the sectoral dimension is introduced by separated estimations of the defined model, for each sector  $k$  being individually examined. In addition, estimation for the aggregate  $K$  is considered. In that case,  $RBc$ ,  $RDC$ ,  $RBPC$ ,  $RDPc$  are taken out of the above specified model.

Taking into account the spatial dimension appears all the more desirable as the geographical unit to which are related firm demographics (or the distance that separates them from each other) is small. Data that are collected at a very disaggregated geographical level such as the Belgian communes invite to spatialize econometrics. Retailing is however an industry that appears rather local. For that, the truncated distance measure makes it possible to introduce a non-linear differentiation of potential spatial interactions with regard to firm demographics. The function overweighs the effects of firm births and deaths relating to very close local entities.

Notice that the estimated equations are consistent with general guiding principles entering the specification of a spatial econometric model, namely: spatial interdependence, spatial asymmetry, allotopy, *ex ante/ex post* distinction and geography (Klaassen & Paelinck, 1979; Jayet, 1993, pp. 70-71).

*Spatial interdependence* appears through a distances matrix (*geography principle*) between Belgian local entities<sup>11</sup>. *Spatial asymmetry* is translated by weights into the matrix (in fact by the number of births and deaths, according to the above specification). *Allotopy* or, in other words, the fact that a localized phenomenon can be under the influence of external factors, is described in the deterministic part of the model (autoregressive<sup>12</sup> model). The introduction of time lags into the explanatory part (*ex ante/ex post distinction*) offers the advantage of logical distinction between causes and effects (the past can explain the present, the reverse is not true); it facilitates greatly econometrics.

For some sectors, the dependent variable frequently equals zero. The truncated distribution of the variable is explained by a significant level of sectoral and

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<sup>10</sup> The exhaustive matrix of distances is taken from “Distances euclidiennes calculées sur base des coordonnées des centroïdes des communes (en projection Lambert belge)”, G. Caruso, Dpt de Géographie, UCL, 2000, electronic file.

<sup>11</sup> Notice that we were not able to integrate spatial interactions between Belgian and foreign frontiers entities. That is undoubtedly a limitation of the present research.

<sup>12</sup> Corrections for heteroscedasticity using Huber-White-sandwich robust estimators should prevent the specification of possible rival models (autoregressive models with spatial structure within residuals covariance, for example).

geographical disaggregation<sup>13</sup>. It invites the use of a Tobit model (Greene, 1997; Long, 1997) and maximum likelihood estimations. Data suggests alternatively the use of a Negative Binomial regression model where the dependant variable is a nonnegative count variable. This is the approach we consider here<sup>14</sup>.

A Negative Binomial model is very similar to Poisson. The difference consists in overdispersion of the events (of the number of counts) (Long, 1997). We use the “gnbreg” command of the econometric Intercooled STATA 6.0 software package.

The stock of firms  $St_{i,96}$  has been chosen as the exposure variable. A specific parameter ( $\ln \alpha$ ) takes into account the extra-Poisson variation. For most of the regressions, the parameter has moreover been modeled as a linear function of the stock of firms  $St_{i,96}$ . The denoted exceptions are explained by casual difficulties to get satisfying maximum likelihood estimations that disappear with the withdrawal of the above linear specification.

### 2.3. Estimation results<sup>15</sup>

Table II presents the estimation results obtained for firm births (NB00) and deaths (ND00) equations relating to each sector  $k$  and to their aggregate  $K$ .

[Insert Table II]

Results give rise, first, to general comments about the global specification of the estimated model (see the two last columns of the table). It appears that the specified model is able to pass the Wald tests at 5% level in all cases, and at 1% level in all cases except one (that is the birth regression relating to the repair of motor vehicles industry). In other words, the model appears to have globally a significant explanatory power of the current number of firm births or of firm deaths whatever the selected sector may be. This is true also with regard to the aggregate  $K$ .

A more detailed examination is interested in the effects (signs) attached to the different variables that enter the model. We will first consider regressions explaining firm births (NB00).

For all regressions are found significant positive effects from past firm births (RB9799). That corresponds according to theory to Net Multiplier effects. These effects are combined with significant Net Competition effects from past firm deaths (RD9799) with regard to bars and coffee-houses and the aggregate  $K$ .

Other interesting results relate to:

- the specialized food retailing industry, where significant positive effects from past deaths in other sectors (RD9799c) can be noticed. It can be interpreted as local

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<sup>13</sup> Moreover, sectoral and spatial disaggregation gives rise to indeterminacy problems in births and deaths rates computation (zero values divided by positive or zero values). Our answer was to give the determinant a value equal to 1 when the ratio was 1 (or a higher value) divided by zero, and a value equal to zero for each ratio corresponding to zero divided by zero.

<sup>14</sup> See Dejardin (2001) for Tobit.

<sup>15</sup> Tables in appendix.

specialization process or, referring to the model of section 1.3, as business allocation reshape according to relative profits;

- restaurants, with Net Multiplier effects (or complementary effects) from past births in other sectors (*RB9799c*).

Notice also significant effects in the trade of motor vehicles from spatially close births and deaths in other sectors (*RBPc* and *RDPc*).

With regard to firm deaths (*RD00*), overall significant positive effects are estimated from past firm births (*RB9799*). That can be interpreted as Net Competition effects but also as Marshall effects. This last effect can certainly not be neglected in retailing industry.

A major result consists in significant positive effects from past firm deaths (*RD9799*) in the aggregate while they are revealed in only one specific sector, the repair of motor vehicles, and even with significant negative signs (Net Competition effects) in the specialized food retailing. An interpretation can be as follows: there would be “spill-over effects” between sectors, creating a “depressionary movement” or a “reversed multiplier” (a “reversed cumulative process”), firm deaths involving new ones and affecting the whole portfolio of economic activities.

The same interpretation can be used with regard to significant positive effects from past deaths in other sectors (*RD9799c*) in the trade of motor vehicles, the repair of motor vehicles industry, the specialized food retailing, bars and coffee-houses.

We found relatively little evidence of significant spatial interactions.

Results are supported by joined tests.

[Insert table VII]

In order to assess the generality of the above outcomes with regard to the whole of Belgian local entities, we have divided the observations into four subgroups. Criteria that have been used are the median population density (number of habitants per square kilometer the first of January 1997) and the median population growth rate (as computed between the first of January 1997 and the 31st of December 1999)<sup>16</sup>. They are some arguments to distinguish located firm demographics according to proxies for demand shocks and market size (see Carree, 1997; Carree & Thurik, 1999).

Results for the four subgroups of local entities are presented in tables III to VI. Corresponding joined tests are in tables VIII to XI.

[Insert tables III to VI]

[Insert tables VIII to XI]

Some features can be emphasized from a broad lecture:

- the model keeps a significant explanatory power in a vast majority of regressions. There are however some noteworthy bad results that concern more particularly the

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<sup>16</sup> Sources : National Institute of Statistics.

- two subgroups of local entities with (1) low population density and high population growth and (2) low population density and low population growth;
- with regard to firm births (*NB00*), significant positive effects from past firm births (*RB9799*) remain, for all subgroups, in the aggregate *K*, and in most sectors for entities with high population density and low population growth. A detailed study could confirm that this subgroup includes a majority of old urbanized entities in Belgium. The result could therefore reveal a trend for concentration of retailing firms in cities. This is consistent with agglomeration economies arguments<sup>17</sup>. Net Competition effects from past firm deaths (*RD9799*) disappear with regard to bars and coffee-houses in two subgroups (subgroups with low population growth). They remain for all aggregates except one (subgroup with low population density and low population growth);
  - with regard to firm deaths (*ND00*), significant positive effects from past firm births (*RB9799*) remain in a majority of regressions, supporting the argument of Net Competition effects or Marshall effects;
  - a “reversed multiplier”, firm deaths involving new ones, is still found in the aggregate *K* for two subgroups (with low population density and high population growth and high population density and low population growth). Given the characteristics of the subgroups and the above results with regard to firm births (*NB00*), this suggests complex adjustment processes and contributes to fix the limits of the present study.

### 3. Conclusions

Firm demography has already received numerous analytical and empirical treatments from different approaches in economics. The present paper has been located at the intersection of two axes that were respectively associated with industrial economics and general economic inquiry that allows for potential spatial interactions between economic phenomena.

In a first theoretical part, the contribution has extended an analytical framework for firm demography due to Johnson & Parker (1994). These authors have proposed to summarize the interactions of firm births and firm deaths in terms of Multiplier, Competition and Marshall effects. Extension have consisted in fully integrating the (inter)sectoral dimension. The discussion of sectoral aggregation-disaggregation leads to the proposal of Net effects resulting from weighted Multiplier and Competition effects. Sectoral disaggregation and consequently homogenisation of activities within each sector would reinforce the Competition effect to the detriment of the Multiplier effect. The presentation of a formal monopolistic model that emphasizes the incidence of product variety and elasticities of substitution on relative profits introduces however new analytical results and questions. In particular, the model puts forward potential cross-sectoral effects in terms of entries and exits that correspond to equilibrating processes given profits inequalities, as well as Multiplier effects between products or activities that are close substitutes. The distinction of complementary activities à la Hicks & Allen (1934) introduces new questions that are more particularly addressed to empirical research. The multiplier effect may be important even within very specialised sectors.

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<sup>17</sup> See Ottaviano & Puga (1998).

The extended analytical framework has been submitted afterwards to empirical confrontations that relate to Belgium. The exercise consisted in estimating a spatialised econometric model for 6 commercial sectors and their aggregate. The model integrates past entries and exits and allows for spatial and cross-sectoral interactions.

Results reveal a globally significant explanatory power of the model for firm births and deaths. These results appear globally robust with regard to subgroups of observations. They give some support to the analytical framework. In particular, referring to the incidence of the disaggregation degree on the intensity of both Multiplier and Competition effects, estimates distinguish significant Net Multiplier effects on firm deaths emerging from past firm deaths in the aggregate and in only one specific sector. That has been interpreted as a “reversed multiplier” or a “reversed cumulative process”. Although it requires undoubtedly additional analyses and empirical studies, our research has particularly demonstrated the relevance of an (inter)sectoral setting in the study of firm demography.

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Table II. Estimation results (all observations, n=589)

Sector i	Dep. Var.	Const.	RB9799	RD9799	RB9799c	RD9799c	RBP9799	RDP9799	RBP9799c	RDP9799c	Wald $\chi^2(8)$	Signif.
Trade of motor vehicles (NACE 501)	NB00	-3.0984 (.2189) [0.000] ***	.6031 (.2776) [0.030] **	-.0140 (.4303) [0.974]	-.4772 (.8224) [0.562]	-.0376 (.7494) [0.960]	749.06 (677.66) [0.269]	-473.331 (520.21) [0.363]	-2732.69 (1142.51) [0.017] **	-2138.03 (890.28) [0.016] **	20.89	0.0074
	ND00	-3.6200 (.1939) [0.000] ***	.5516 (.2171) [0.011] **	.4523 (.3804) [0.234]	.4885 (.6516) [0.453]	1.3634 (.5611) [0.015] **	402.13 (536.17) [0.453]	-126.22 (398.95) [0.752]	-514.78 (1041.59) [0.621]	275.88 (831.73) [0.740]	154.06	0.0000
Repair of motor vehicles (NACE 502)	NB00	-3.2158 (.2267) [0.000] ***	.7156 (.3459) [0.039] **	.2055 (.4199) [0.624]	.2111 (.7841) [0.788]	.2752 (.8094) [0.734]	423.55 (501.13) [0.398]	-107.30 (384.90) [0.780]	-1146.69 (1431.70) [0.423]	738.62 (1118.39) [0.509]	19.81	0.0111
	ND00	-3.8382 (.1945) [0.000] ***	.7654 (.2830) [0.007] ***	.8177 (.3027) [0.007] ***	1.1880 (.7281) [0.103]	1.4395 (.6438) [0.025] **	360.28 (478.23) [0.451]	-325.46 (369.54) [0.378]	-1140.05 (981.53) [0.245]	921.50 (759.27) [0.225]	55.70	0.0000
Unspecial. retailing trade (NACE 521)	NB00	-4.4849 (.2464) [0.000] ***	1.6429 (.5097) [0.001] ***	.1985 (.4353) [0.648]	-.6625 (.8944) [0.459]	4.2500 (.7754) [0.000]	437.12 (385.69) [0.257]	-365.18 (324.01) [0.260]	822.95 (1537.03) [0.592]	-719.43 (1245.23) [0.563]	80.56	0.0000
	ND00	-2.5936 (.2002) [0.000] ***	1.3280 (.1379) [0.000] ***	-.3076 (.2998) [0.305]	-1.1566 (.6203) [0.062]	0.7772 (.5591) [0.164]	20.72 (312.43) [0.947]	-24.74 (266.61) [0.926]	-348.12 (799.15) [0.663]	308.32 (663.94) [0.642]	195.28	0.0000
Spec. food retailing (NACE 522)	NB00	-3.4951 (.1627) [0.000] ***	.8370 (.3105) [0.007] ***	.1522 (.3593) [0.672]	.1031 (.5445) [0.850]	1.1854 (.4982) [0.017] **	556.48 (615.36) [0.366]	-141.97 (473.27) [0.764]	222.13 (702.65) [0.752]	-307.68 (570.13) [0.589]	32.29	0.0001
	ND00	-2.8656 (.1386) [0.000] ***	1.4826 (.1835) [0.000] ***	-.8614 (.2491) [0.001] ***	.2755 (.4501) [0.540]	.8824 (.4134) [0.033] **	312.25 (413.42) [0.475]	-60.97 (353.21) [0.863]	780.20 (613.78) [0.204]	-736.63 (515.19) [0.153]	89.69	0.0000

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v. ≤ 10% ; \*\* : p. v. ≤ 5% ; \*\*\* : p. v. ≤ 1% ; ° : ln α not modeled.

Table II (cont.). Estimation results (all observations, n=589)

Restaurants (NACE 553)	NB00	-2.7248 (.1041) [0.000]	.8535 (.1317) [0.000]	.1532 (.1665) [0.358]	.6927 (.4056) [0.088]	.2806 (.3603) [0.436]	134.61 (194.34) [0.489]	-98.46 (188.45) [0.601]	-98.95 (1121.0) [0.930]	11.30 (803.64) [0.989]	86.62	0.0000
		***	***		*							
	ND00	-3.0027 (.1111) [0.000]	1.1072 (.1573) [0.000]	.2138 (.1765) [0.226]	.4577 (.4659) [0.326]	.6379 (.3946) [0.106]	128.76 (206.99) [0.534]	-100.01 (199.25) [0.616]	-521.67 (928.39) [0.574]	345.03 (663.94) [0.603]	114.84	0.0000
		***	***									
Bars & coffee-houses (NACE 554)	NB00	-3.1384 (.1213) [0.000]	.9452 (.2498) [0.000]	.5405 (.2517) [0.032]	.1164 (.4272) [0.785]	.0149 (.3932) [0.970]	132.16 (332.42) [0.691]	-16.20 (208.08) [0.938]	-700.66 (669.95) [0.296]	433.44 (570.97) [0.448]	40.74	0.0000
		***	***	**								
	ND00	-2.9264 (.1065) [0.000]	1.1700 (.1918) [0.000]	.0192 (.1895) [0.919]	.1650 (.3319) [0.619]	1.1380 (.3688) [0.002]	194.19 (200.74) [0.333]	-34.26 (128.76) [0.790]	39.57 (551.58) [0.943]	-174.99 (469.45) [0.709]	76.22	0.0000
		***	***			***						
												<b>Wald <math>\chi^2(4)</math></b>
Total (NACE 501, 502, 521, 522, 553, 554)	NB00 °	-3.2767 .0585 [0.000]	1.3904 (.2287) [0.000]	.9716 (.2021) [0.000]			-233.53 (427.89) [0.585]	177.85 (343.83) [0.605]			148.09	0.0000
		***	***	***								
	ND00	-3.0563 (.0597) [0.000]	1.6165 (.2215) [0.000]	.7840 (.1935) [0.000]			109.32 (348.52) [0.754]	-76.856 (277.58) [0.782]			139.38	0.0000
		***	***	***								

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v. ≤ 10% ; \*\* : p. v. ≤ 5% ; \*\*\* : p. v. ≤ 1% ; ° : ln α not modeled.

Table III. Estimation results (median high pop. density and high pop. growth, n=115)

Sector i	Dep. Var.	Const.	RB9799	RD9799	RB9799c	RD9799c	RBP9799	RDP9799	RBP9799c	RDP9799c	Wald $\chi^2(8)$	Signif.
Trade of motor vehicles (NACE 501)	NB00	-3.3625 (.3176) [0.000] ***	.5964 (.8241) [0.469]	.2977 (.7772) [0.702]	-.4041 (1.3744) [0.769]	.5213 (1.1457) [0.649]	448.72 (1171.80) [0.702]	-622.31 (1055.12) [0.555]	-1687.46 (1697.60) [0.320]	1548.61 (1272.44) [0.224]	140.09	0.0000
	ND00	-3.2807 (.3750) [0.000] ***	1.0140 (1.0176) [0.319]	1.8998 (.8794) [0.031]	-1.9027 (1.4172) [0.179]	1.3659 (1.1570) [0.238]	-1098.93 (1239.21) [0.375]	1086.47 (1049.82) [0.301]	-2666.90 (1866.78) [0.153]	1909.27 (1467.96) [0.193]	12.59	0.1267
Repair of motor vehicles (NACE 502)	NB00	-4.078 (.5684) [0.000] ***	-.0164 (1.039) [0.987]	1.0951 (.7998) [0.171]	.8992 (1.6336) [0.582]	1.9229 (1.5898) [0.226]	669.09 (1308.48) [0.609]	-415.33 (804.86) [0.606]	4307.66 (3040.08) [0.156]	-3551.76 (2354.74) [0.131]	10.13	0.2560
	ND00	-3.7858 (.4058) [0.000] ***	2.0098 (.6448) [0.002]	.5297 (.2810) [0.059]	-.0305 (1.5092) [0.984]	2.2058 (1.0099) [0.029]	485.18 (663.76) [0.465]	-248.88 (499.94) [0.619]	-2154.582 (1622.05) [0.184]	1662.70 (1261.44) [0.187]	66.05	0.0000
Unspecial. retailing trade (NACE 521)	NB00	-4.2717 (.5781) [0.000] ***	3.3557 (.8747) [0.000] ***	-1.5115 (.9569) [0.114]	-3.5538 (2.001) [0.076]	5.9216 (1.9218) [0.002]	867.67 (792.17) [0.273]	-439.50 (666.65) [0.510]	7559.21 (2379.29) [0.001]	-6400.55 (1978.40) [0.001]	43.96	0.0000
	ND00	-2.3044 (.4111) [0.000] ***	2.9595 (.5735) [0.000] ***	.2875 (.7698) [0.709]	-2.2631 (1.3469) [0.093]	-.9897 (1.2098) [0.413]	831.87 (507.06) [0.101]	-485.97 (431.99) [0.261]	2059.61 (2001.49) [0.303]	-1822.56 (1629.83) [0.263]	48.96	0.0000
Spec. food retailing (NACE 522)	NB00	-3.0709 (7.8302) [0.695]	1.1198 (13.2902) [0.933]	.2502 (47.5697) [0.996]	-1.0337 (6.3230) [0.870]	.6864 (33.3140) [0.984]	334.36 (31174.92) [0.991]	-401.06 (18212.14) [0.982]	-2102.55 (17462.71) [0.904]	1897.40 (12744.84) [0.882]	5.14	0.7425
	ND00 °	-3.0641 (.2249) [0.000] ***	1.8782 (.5090) [0.000] ***	-.9198 (.7333) [0.210]	.3700 (.8416) [0.660]	1.0753 (.8532) [0.208]	819.48 (816.21) [0.315]	-453.86 (717.03) [0.527]	616.68 (1047.81) [0.556]	-546.84 (903.04) [0.545]	24.71	0.0017

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v. ≤ 10% ; \*\* : p. v. ≤ 5% ; \*\*\* : p. v. ≤ 1% ; ° : ln α not modeled.

Table III (cont.). Estimation results (median high pop. density and high pop. growth, n=115)

Restaurants (NACE 553)	NB00	-2.7491 (.2256) [0.000]	1.1804 (.3455) [0.001]	.2544 (.4488) [0.571]	.1381 (.7944) [0.862]	.1084 (.6883) [0.875]	381.16 (315.52) [0.227]	-350.21 (334.55) [0.295]	834.42 (1580.87) [0.598]	-617.28 (1177.46) [0.600]	39.44	0.0000
		***	***									
	ND00	-3.1046 (.2172) [0.000]	1.1610 (.3721) [0.002]	.6473 (.3267) [0.048]	.5929 (.9868) [0.548]	-.0271 (.8440) [0.974]	77.548 (459.85) [0.866]	131.05 (461.11) [0.776]	695.08 (1759.70) [0.693]	-785.87 (1266.25) [0.535]	454.90	0.0000
		***	***	**								
Bars & coffee-houses (NACE 554)	NB00 °	-2.9410 (.2043) [0.000]	.7114 (.4476) [0.112]	1.0653 (.3545) [0.003]	.5982 (.8398) [0.476]	-1.5028 (.9098) [0.099]	-539.56 (547.52) [0.324]	439.69 (343.99) [0.201]	-1009.00 (1054.62) [0.339]	621.47 (930.61) [0.504]	29.96	0.0002
		***		***		*						
	ND00	-2.8002 (.2329) [0.000]	1.7196 (.3851) [0.000]	.1871 (.3756) [0.618]	-.3989 (.7912) [0.614]	.0683 (.8819) [0.938]	152.58 (328.78) [0.643]	-25.51 (208.99) [0.903]	706.71 (947.27) [0.456]	-701.84 (804.16) [0.383]	42.08	0.0000
		***	***									
												<b>Wald <math>\chi^2(4)</math></b>
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	-3.2145 (.1120) [0.000]	1.0023 (.3599) [0.005]	1.0919 (.3602) [0.002]			-6.0743 (630.15) [0.992]	8.0011 (501.94) [0.987]			41.08	0.0000
		***	***	***								
	ND00	-3.0431 (.1028) [0.000]	1.6120 (.3876) [0.000]	.5746 (.3874) [0.138]			730.63 (708.51) [0.302]	-568.06 (566.09) [0.316]			48.15	0.0000
		***	***									

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v. ≤ 10% ; \*\* : p. v. ≤ 5% ; \*\*\* : p. v. ≤ 1% ; ° : ln α not modeled.

Table IV. Estimation results (median low pop. density and high pop. growth, n=180)

Sector i	Dep. Var.	Const.	RB9799	RD9799	RB9799c	RD9799c	RBP9799	RDP9799	RBP9799c	RDP9799c	Wald $\chi^2(8)$	Signif.
Trade of motor vehicles (NACE 501)	NB00	-3.3362 (.5823) [0.000] ***	-.3674 (.7544) [0.626] ***	-1.5007 (.8582) [0.080] *	.0861 (1.7575) [0.961] ***	.8379 (1.5109) [0.579] ***	1744.59 (636.45) [0.006] ***	-720.03 (691.68) [0.298] ***	-1387.00 (2318.61) [0.550] ***	1159.63 (1940.96) [0.550] ***	34.36	0.0000
	ND00	-3.0947 (.5868) [0.000] ***	.4142 (.6880) [0.547] ***	-.3960 (.8368) [0.636] ***	-2.9240 (1.8872) [0.121] **	2.6510 (1.2643) [0.036] **	432.39 (1856.87) [0.816] ***	-2444.48 (1512.07) [0.106] ***	-2714.81 (3519.22) [0.440] ***	2931.03 (2993.25) [0.327] ***	14.04	0.0808
Repair of motor vehicles (NACE 502)	NB00	-2.6248 (.5086) [0.000] ***	1.2416 (.5402) [0.022] **	-1.0190 (1.2246) [0.405] ***	-.6410 (1.7376) [0.712] ***	.1438 (1.3933) [0.918] ***	-588.48 (1659.69) [0.723] ***	365.82 (2341.98) [0.876] ***	-1753.03 (3697.16) [0.635] ***	829.58 (2615.42) [0.751] ***	6.20	0.6248
	ND00	-3.2447 (.4460) [0.000] ***	.7297 (.6232) [0.242] ***	.1379 (.7264) [0.849] ***	2.1238 (1.5297) [0.165] ***	-.9223 (1.3175) [0.484] ***	596.56 (1338.28) [0.656] ***	-1624.84 (1846.34) [0.379] ***	-937.721 (2374.91) [0.693] ***	1037.21 (1751.69) [0.554] ***	5.09	0.7481
Unspecial. retailing trade (NACE 521)	NB00	-3.8577 (.5039) [0.000] ***	.7397 (.8006) [0.356] ***	-.0780 (.6156) [0.899] ***	-2.6555 (1.5369) [0.084] *	4.6142 (1.5136) [0.002] ***	-716.55 (1368.37) [0.601] ***	792.70 (796.36) [0.320] ***	400.618 (3058.52) [0.896] ***	-652.99 (2570.56) [0.799] ***	28.28	0.0004
	ND00	-2.4041 (.4553) [0.000] ***	1.2973 (.4921) [0.008] ***	-.8594 (.5692) [0.131] ***	-1.9156 (1.4760) [0.194] ***	1.1501 (1.1221) [0.305] ***	148.27 (744.48) [0.842] ***	382.26 (496.82) [0.442] ***	-2643.36 (2156.52) [0.220] ***	1860.94 (1764.93) [0.292] ***	83.77	0.0000
Spec. food retailing (NACE 522)	NB00	-3.6532 (.4627) [0.000] ***	.3733 (.5904) [0.527] ***	.7078 (.6762) [0.295] ***	2.8755 (1.3214) [0.030] **	-.7229 (1.0975) [0.510] *	2682.42 (1400.99) [0.056] *	-1525.93 (1022.23) [0.136] ***	-340.51 (1624.30) [0.834] ***	-17.16 (1275.89) [0.989] ***	12.62	0.1257
	ND00	-2.5335 (.3437) [0.000] ***	1.1667 (.4514) [0.010] ***	-.8948 (.5163) [0.083] *	-.5205 (1.0936) [0.634] ***	.5205 (.8040) [0.517] ***	714.56 (1368.78) [0.602] ***	-141.44 (971.53) [0.884] ***	17.06 (1720.14) [0.992] ***	-212.50 (1460.69) [0.884] ***	10.91	0.2066

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v. ≤ 10% ; \*\* : p. v. ≤ 5% ; \*\*\* : p. v. ≤ 1% ; ° : ln α not modeled.

Table IV (cont.). Estimation results (median low pop. density and high pop. growth, n=180)

Restaurants (NACE 553)	NB00	-2.4189 (.3097) [0.000]	.7947 (.3105) [0.010]	.1217 (.3191) [0.703]	-.7737 (.9275) [0.404]	.5668 (.7499) [0.450]	-133.60 (604.23) [0.825]	160.92 (604.43) [0.790]	-1114.43 (2362.42) [0.637]	434.97 (1994.29) [0.827]	13.40	0.0988
		***	***									
	ND00	-3.0545 (.3003) [0.000]	1.0149 (.3206) [0.002]	.1439 (.3069) [0.639]	.4398 (.9846) [0.655]	1.3641 (.8369) [0.103]	157.09 (517.40) [0.761]	140.46 (573.16) [0.806]	-1948.48 (1883.25) [0.301]	747.32 (1369.89) [0.585]	23.85	0.0024
		***	***									
Bars & coffee-houses (NACE 554)	NB00	-3.7403 (.3158) [0.000]	.5157 (.4631) [0.266]	1.0330 (.5839) [0.077]	1.0253 (.9172) [0.264]	.9120 (1.0049) [0.364]	-1770.33 (939.97) [0.060]	1331.42 (666.64) [0.046]	1941.352 (1496.37) [0.195]	-1606.24 (1276.41) [0.208]	19.99	0.0104
		***		*			*	**				
	ND00	-3.0294 (.2452) [0.000]	.5058 (.3709) [0.173]	.6601 (.3970) [0.096]	1.8317 (.7036) [0.009]	.0080 (.7262) [0.991]	961.75 (775.71) [0.215]	-505.38 (603.56) [0.402]	1193.75 (1142.72) [0.296]	-1405.28 (1006.45) [0.163]	26.10	0.0010
		***		*	***							
												<b>Wald <math>\chi^2(4)</math></b>
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	-3.2356 (.1446) [0.000]	1.0266 (.5187) [0.048]	1.0885 (.4407) [0.014]			-489.04 (1187.82) [0.681]	320.50 (998.35) [0.748]			16.69	0.0022
		***	**	**								
	ND00	-3.0219 (.1483) [0.000]	1.4067 (.5060) [0.005]	.8513 (.3695) [0.021]			-446.53 (828.35) [0.590]	330.64 (681.81) [0.628]			17.87	0.0013
		***	***	**								

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v.  $\leq$  10% ; \*\* : p. v.  $\leq$  5% ; \*\*\* : p. v.  $\leq$  1% ; ° : ln  $\alpha$  not modeled.

Table V. Estimation results (median high pop. density and low pop. growth, n=180)

Sector i	Dep. Var.	Const.	RB9799	RD9799	RB9799c	RD9799c	RBP9799	RDP9799	RBP9799c	RDP9799c	Wald $\chi^2(8)$	Signif.
Trade of motor vehicles (NACE 501)	NB00	-3.0925 (.3539) [0.000] ***	1.8200 (.8856) [0.040] **	.4984 (.8433) [0.555]	-.7198 (1.5508) [0.643]	-.5052 (1.5307) [0.741]	-609.57 (1182.59) [0.606]	641.74 (885.40) [0.469]	-9047.76 (2382.77) [0.000] ***	6918.19 (1823.22) [0.000] ***	27.57	0.0006
	ND00	-3.7696 (.2648) [0.000] ***	1.5354 (.5591) [0.006] ***	.6249 (.5317) [0.240]	2.0574 (.9968) [0.039] **	.0657 (.8860) [0.941]	3.8983 (799.75) [0.996]	146.06 (605.24) [0.809]	2323.45 (1453.13) [0.110]	-2005.82 (1168.63) [0.086] *	194.52	0.0000
Repair of motor vehicles (NACE 502)	NB00	-4.0959 (.3723) [0.000] ***	.6223 (.5954) [0.296] ***	.0832 (.8915) [0.926]	.0238 (1.4758) [0.987]	2.8582 (1.5846) [0.071] *	1560.87 (1194.68) [0.191]	-877.34 (886.07) [0.322] **	-6040.43 (2391.33) [0.012] **	4540.12 (1853.52) [0.014] **	25.33	0.0014
	ND00 °	-4.4382 (.3190) [0.000] ***	1.1238 (.5196) [0.031] **	.7304 (.7574) [0.335]	-.1273 (1.1977) [0.915]	3.9242 (1.1034) [0.000] ***	619.84 (1019.32) [0.543]	-676.02 (741.02) [0.362]	-1052.28 (2049.62) [0.608]	881.86 (1574.25) [0.575]	45.78	0.0000
Unspecial. retailing trade (NACE 521)	NB00	-4.7377 (.3261) [0.000] ***	2.7542 (.7890) [0.000] ***	.6547 (.8495) [0.441]	.4837 (1.3100) [0.712]	3.0767 (1.1557) [0.008] ***	1751.78 (738.06) [0.018] **	-1558.07 (621.11) [0.012] **	-359.38 (2992.29) [0.904]	271.57 (2400.19) [0.910]	102.59	0.0000
	ND00	-2.8215 (.3160) [0.000] ***	1.0312 (.5567) [0.064] *	.1164 (.5146) [0.821]	.2110 (.9576) [0.826]	.3044 (.9310) [0.744]	255.27 (408.84) [0.532]	-198.26 (345.54) [0.566]	120.86 (1777.88) [0.946]	-126.62 (1427.89) [0.929]	586.57	0.0000
Spec. food retailing (NACE 522)	NB00	-3.9092 (.2205) [0.000] ***	1.2649 (.5102) [0.013] **	.5324 (.5305) [0.316]	-.1262 (.8923) [0.888]	1.9225 (0.8428) [0.023] **	695.18 (1064.91) [0.514]	-276.93 (813.27) [0.733]	2484.50 (1175.31) [0.035] **	-2097.97 (972.97) [0.031] **	41.52	0.0000
	ND00	-3.0120 (.2249) [0.000] ***	1.7332 (.4578) [0.000] ***	-.8040 (.4305) [0.062] *	.6069 (.7569) [0.423]	.9730 (.8068) [0.228]	424.91 (952.64) [0.656]	-195.44 (695.46) [0.779]	2024.89 (1156.23) [0.080] *	-1731.91 (935.23) [0.064] *	25.76	0.0012

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v. ≤ 10% ; \*\* : p. v. ≤ 5% ; \*\*\* : p. v. ≤ 1% ; ° : ln α not modeled.

Table V (cont.). Estimation results (median high pop. density and low pop. growth, n=180)

Restaurants (NACE 553)	NB00	-2.6859 (.1548) [0.000]	.9904 (.2207) [0.000]	-.1614 (.2704) [0.550]	1.3816 (.6551) [0.035]	-.1286 (.6218) [0.836]	247.43 (338.56) [0.465]	-201.99 (317.85) [0.525]	-64.38 (2069.87) [0.975]	-28.11 (1468.96) [0.985]	52.31	0.0000
		***	***		**							
	ND00	-2.8671 (.1652) [0.000]	.9388 (.2966) [0.002]	.4601 (.3260) [0.158]	.4040 (.7186) [0.574]	.2178 (.6124) [0.722]	-137.69 (307.54) [0.654]	97.43 (286.89) [0.734]	189.09 (1683.73) [0.911]	-73.43 (1198.44) [0.951]	42.31	0.0000
		***	***									
Bars & coffee-houses (NACE 554)	NB00	-3.2092 (.1900) [0.000]	1.3857 (.4284) [0.001]	.2717 (.4667) [0.560]	-.8328 (.6809) [0.221]	.9491 (.5481) [0.083]	647.24 (556.21) [0.245]	-361.52 (374.68) [0.335]	-892.25 (1277.92) [0.485]	620.15 (1065.80) [0.561]	29.76	0.0002
		***	***			*						
	ND00	-2.9764 (.1410) [0.000]	1.0671 (.3194) [0.001]	.1054 (.3155) [0.738]	-.1022 (.4594) [0.824]	1.6432 (.4724) [0.001]	140.33 (343.82) [0.683]	33.50 (233.13) [0.886]	-9623 (969.21) [0.999]	-195.24 (870.35) [0.823]	51.29	0.0000
		***	***			***						
												<b>Wald <math>\chi^2(4)</math></b>
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	-3.4140 (.0804) [0.000]	1.7478 (.3577) [0.000]	1.1196 (.3191) [0.000]			-619.98 (746.32) [0.406]	474.68 (599.60) [0.429]			122.47	0.0000
		***	***	***								
	ND00	-3.1294 (.0956) [0.000]	1.6211 (.3786) [0.000]	1.0710 (.3405) [0.002]			565.92 (517.20) [0.274]	-442.94 (411.44) [0.282]			76.45	0.0000
		***	***	***								

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v.  $\leq$  10% ; \*\* : p. v.  $\leq$  5% ; \*\*\* : p. v.  $\leq$  1% ; ° : ln  $\alpha$  not modeled.

Table VI. Estimation results (median low pop. density and low pop. growth, n=114)

Sector i	Dep. Var.	Const.	RB9799	RD9799	RB9799c	RD9799c	RBP9799	RDP9799	RBP9799c	RDP9799c	Wald $\chi^2(8)$	Signif.
Trade of motor vehicles (NACE 501)	NB00	-2.1607 (.5375) [0.000]	1.1428 (.6006) [0.057]	.5691 (.6371) [0.372]	-.3590 (1.6052) [0.823]	-4.4001 (1.8506) [0.017]	935.02 (859.00) [0.276]	2655.14 (723.67) [0.000]	6283.36 (4412.72) [0.154]	-7332.26 (3615.15) [0.043]	77.00	0.0000
		***	*			**		***		**		
	ND00	-3.3175 (.5194) [0.000]	1.0205 (.4057) [0.012]	-.3712 (.6902) [0.591]	.9192 (1.4340) [0.522]	-.1611 (1.6011) [0.920]	1208.25 (777.05) [0.120]	-1199.47 (1220.70) [0.326]	-2648.39 (2842.28) [0.351]	2169.43 (2347.05) [0.355]	533.95	0.0000
		***	**									
Repair of motor vehicles (NACE 502)	NB00 °	-1.7346 (.5177) [0.001]	.7905 (.6924) [0.254]	-.2669 (.7941) [0.737]	.2959 (1.9393) [0.879]	-3.8247 (1.6754) [0.022]	1776.75 (1678.71) [0.290]	-1247.09 (1082.56) [0.249]	-786.80 (4557.91) [0.863]	64.11 (3624.22) [0.986]	9.61	0.2934
		***				**						
	ND00	-3.2924 (.3840) [0.000]	-1.0246 (.6843) [0.134]	.9319 (.6577) [0.156]	1.1837 (1.4095) [0.401]	.6059 (1.4130) [0.668]	2483.17 (1370.91) [0.070]	-1169.43 (1078.34) [0.278]	-5003.80 (2818.58) [0.076]	4020.41 (2296.70) [0.080]	76.52	0.0000
		***					*		*	*		
Unspecial. retailing trade (NACE 521)	NB00 °	-3.0804 (.7429) [0.000]	-1.1585 (1.1390) [0.309]	-.8786 (1.1480) [0.444]	-.3353 (2.2531) [0.882]	.8110 (2.6902) [0.763]	-3403.82 (2218.09) [0.125]	2075.05 (1228.37) [0.091]	-4938.93 (2724.25) [0.070]	4020.60 (2420.22) [0.097]	10.51	0.2309
		***						*	*	*		
	ND00	-2.2525 (.5045) [0.000]	1.0519 (.1452) [0.000]	-1.2503 (.7557) [0.098]	-1.4104 (1.7722) [0.426]	.5411 (1.3586) [0.690]	-670.34 (1666.11) [0.687]	631.97 (937.67) [0.500]	-613.69 (3692.46) [0.868]	274.65 (3241.27) [0.932]	444.89	0.0000
		***	***	*								
Spec. food retailing (NACE 522)	NB00	-2.4328 (.6633) [0.000]	.6964 (.8130) [0.392]	-.8179 (1.1277) [0.468]	-3.0409 (1.7686) [0.086]	1.1975 (1.8800) [0.524]	-1953.04 (1549.57) [0.208]	1619.98 (968.40) [0.094]	-942.16 (2848.16) [0.741]	640.14 (2550.29) [0.802]	10.91	0.2067
		***			*			*				
	ND00	-2.3154 (.3322) [0.000]	1.1901 (.2181) [0.000]	-.9213 (.4822) [0.056]	-1.1341 (1.0236) [0.268]	.1588 (.9617) [0.869]	-993.32 (704.86) [0.159]	1037.85 (570.14) [0.069]	220.32 (1301.31) [0.866]	-344.80 (1173.81) [0.769]	64.38	0.0000
		***	***	*				*				

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v. ≤ 10% ; \*\* : p. v. ≤ 5% ; \*\*\* : p. v. ≤ 1% ; ° : ln α not modeled.

Table VI (cont.). Estimation results (median low pop. density and low pop. growth, n=114)

Restaurants (NACE 553)	NB00	-2.8428 (.3041) [0.000]	.8091 (.2489) [0.001]	.3552 (.3495) [0.309]	2.3836 (1.0998) [0.030]	-.7400 (1.1459) [0.518]	817.02 (612.99) [0.183]	-65.15 (718.18) [0.928]	-756.80 (3824.23) [0.843]	-1155.61 (2844.05) [0.685]	52.83	0.0000
		***	***		**							
	ND00	-2.5373 (.2892) [0.000]	.9834 (.3122) [0.002]	-.4427 (.3541) [0.211]	-.2122 (1.2238) [0.862]	.4168 (1.1994) [0.728]	1218.71 (550.60) [0.027]	-1160.82 (571.40) [0.042]	-1497.77 (2653.53) [0.572]	958.98 (1967.37) [0.626]	31.72	0.0001
		***	***				**	**				
Bars & coffee-houses (NACE 554)	NB00	-2.8639 (.3868) [0.000]	1.1884 (.6430) [0.065]	-.1769 (.6325) [0.780]	.9358 (1.0133) [0.356]	-.8821 (1.0104) [0.383]	161.77 (1360.72) [0.905]	-240.18 (1002.34) [0.811]	1137.04 (1692.85) [0.502]	-807.11 (1249.09) [0.518]	8.22	0.4124
		***	**									
	ND00	-2.8615 (.2610) [0.000]	1.9722 (.5326) [0.000]	-1.2256 (.5303) [0.021]	-.5491 (1.0576) [0.604]	2.0778 (.7961) [0.009]	261.58 (1059.25) [0.805]	-15.57 (849.50) [0.985]	-1162.89 (1501.99) [0.439]	767.56 (1131.72) [0.498]	22.28	0.0044
		***	***	**		***						
												<b>Wald <math>\chi^2(4)</math></b>
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	-2.8535 (.1856) [0.000]	1.5642 (.7295) [0.032]	-.7000 (.5621) [0.213]			94.65 (1195.11) [0.937]	-97.31 (970.28) [0.920]			4.74	0.3146
		***	**									
	ND00	-2.8164 (.1392) [0.000]	1.4986 (.5187) [0.004]	0.0272 (.4582) [0.953]			-1004.14 (1026.31) [0.328]	845.31 (841.86) [0.315]			11.74	0.0194
		***	***									

( ) : Standard deviation ; [ ] : Prob-value ; \* : p. v.  $\leq$  10% ; \*\* : p. v.  $\leq$  5% ; \*\*\* : p. v.  $\leq$  1% ; ° : ln  $\alpha$  not modeled.

Table VII. Joined tests (all observations, n=589)

Sector i	Dep. Var.	H <sub>0</sub> : RB, RD=0 $\chi^2(2)$	H <sub>0</sub> : RB+RD=0 $\chi^2(1)$	H <sub>0</sub> : RBc, RDc=0 $\chi^2(2)$	H <sub>0</sub> : RBc+RDc=0 $\chi^2(1)$	H <sub>0</sub> : RBP, RDP=0 $\chi^2(2)$	H <sub>0</sub> : RBP+RDP=0 $\chi^2(1)$	H <sub>0</sub> : RBPc, RDPc=0 $\chi^2(2)$	H <sub>0</sub> : RBPc+RDPc=0 $\chi^2(1)$	Global specification $\chi^2(8)$
Trade of motor vehicles (NACE 501)	NB00	10.64 [0.0049]***	4.21 [0.0402]**	0.55 [0.7612]	0.49 [0.4847]	2.42 [0.2979]	2.21 [0.1372]	5.77 [0.0558]*	5.19 [0.0228]**	20.89 [0.0074]***
	ND00	37.45 [0.0000]***	17.45 [0.0000]***	10.20 [0.0061]***	8.40 [0.0038]***	20.10 [0.0000]***	3.65 [0.0561]*	5.38 [0.0678]*	1.18 [0.2777]	154.06 [0.0000]***
Repair of motor vehicles (NACE 502)	NB00	5.97 [0.0506]*	4.38 [0.0364]**	0.43 [0.8075]	0.43 [0.5134]	6.84 [0.0327]**	4.35 [0.0370]**	5.15 [0.0763]*	1.59 [0.2079]	19.81 [0.0111]**
	ND00	23.76 [0.0000]***	23.70 [0.0000]***	18.72 [0.0001]***	17.98 [0.0000]***	0.88 [0.6433]	0.05 [0.8293]	2.40 [0.3016]	0.93 [0.3353]	55.70 [0.0000]***
Unspecial. retailing trade (NACE 521)	NB00	12.66 [0.0018]***	10.79 [0.0010]***	38.95 [0.0000]***	21.52 [0.0000]***	1.28 [0.5261]	0.96 [0.3268]	1.44 [0.4872]	0.12 [0.7274]	80.56 [0.0000]***
	ND00	96.95 [0.0000]***	8.86 [0.0029]***	3.96 [0.1384]	0.35 [0.5561]	0.16 [0.9230]	0.01 [0.9356]	0.49 [0.7811]	0.08 [0.7772]	195.28 [0.0000]***
Spec. food retailing (NACE 522)	NB00	9.19 [0.0101]**	6.43 [0.0112]**	7.46 [0.0239]**	5.33 [0.0209]**	3.65 [0.1614]	3.26 [0.0709]*	1.65 [0.4380]	0.23 [0.6282]	32.29 [0.0001]***
	ND00	66.20 [0.0000]***	5.79 [0.0162]**	7.48 [0.0238]**	6.33 [0.0119]**	3.47 [0.1763]	3.02 [0.0824]*	2.88 [0.2365]	0.11 [0.7406]	89.69 [0.0000]***
Restaurants (NACE 553)	NB00	49.06 [0.0000]***	29.89 [0.0000]***	6.61 [0.0366]**	6.54 [0.0105]**	1.41 [0.4938]	1.24 [0.2657]	1.89 [0.3894]	0.07 [0.7851]	86.62 [0.0000]***
	ND00	69.91 [0.0000]***	52.84 [0.0000]***	7.95 [0.0188]**	7.32 [0.0068]***	0.84 [0.6555]	0.69 [0.4045]	0.66 [0.7191]	0.43 [0.5131]	114.84 [0.0000]***
Bars & coffee-houses (NACE 554)	NB00	33.94 [0.0000]***	32.96 [0.0000]***	0.12 [0.9400]	0.11 [0.7377]	2.45 [0.2935]	0.73 [0.3928]	3.93 [0.1401]	3.59 [0.0582]	40.74 [0.0000]***
	ND00	44.74 [0.0000]***	32.21 [0.0000]***	12.94 [0.0016]***	11.27 [0.0008]***	9.00 [0.0111]**	3.84 [0.0500]**	4.12 [0.1276]	1.47 [0.2261]	76.22 [0.0000]***
										$\chi^2(4)$
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	144.97 [0.0000]***	144.42 [0.0000]***			0.93 [0.6287]	0.43 [0.5132]			148.09 [0.0000]***
	ND00	136.52 [0.0000]***	136.29 [0.0000]***			0.92 [0.6300]	0.20 [0.6522]			139.38 [0.0000]***

[ ] : Prob-value (p.v.) of H<sub>0</sub> ; \* : p. v. ≤ 10% ; \*\* : p. v. ≤ 5% ; \*\*\* : p. v. ≤ 1%.

Table VIII. Joined tests (median high pop. density and high pop. growth, n=115)

Sector i	Dep. Var.	H <sub>0</sub> : RB, RD=0 $\chi^2(2)$	H <sub>0</sub> : RB+RD=0 $\chi^2(1)$	H <sub>0</sub> : RBc, RDc=0 $\chi^2(2)$	H <sub>0</sub> : RBc+RDc=0 $\chi^2(1)$	H <sub>0</sub> : RBP, RDP=0 $\chi^2(2)$	H <sub>0</sub> : RBP+RDP=0 $\chi^2(1)$	H <sub>0</sub> : RBPc, RDPc=0 $\chi^2(2)$	H <sub>0</sub> : RBPc+RDPc=0 $\chi^2(1)$	Global specification $\chi^2(8)$
Trade of motor vehicles (NACE 501)	NB00	0.72 [0.6977]	0.68 [0.4104]	0.21 [0.9010]	0.01 [0.9205]	0.75 [0.6885]	0.25 [0.6140]	5.06 [0.0798]*	0.09 [0.7612]	140.09 [0.0000]***
	ND00	5.77 [0.0558]*	4.81 [0.0283]**	2.20 [0.3326]	0.16 [0.6916]	1.32 [0.5158]	0.00 [0.9700]	3.56 [0.1683]	3.09 [0.0786]*	12.59 [0.1267]
Repair of motor vehicles (NACE 502)	NB00	2.98 [0.3537]	0.98 [0.3212]	2.77 [0.2500]	2.59 [0.1075]	0.28 [0.8715]	0.15 [0.6966]	3.26 [0.1964]	1.09 [0.2961]	10.13 [0.2560]
	ND00	31.01 [0.0000]***	22.96 [0.0000]***	6.61 [0.0367]**	2.83 [0.0923]*	0.66 [0.7178]	0.59 [0.4429]	1.77 [0.4137]	1.59 [0.2075]	66.05 [0.0000]***
Unspecial. retailing trade (NACE 521)	NB00	18.96 [0.0001]***	1.81 [0.1790]	9.50 [0.0086]***	1.83 [0.1759]	1.66 [0.4353]	1.37 [0.2424]	10.54 [0.0051]	5.75 [0.0165]	43.96 [0.0000]***
	ND00	26.78 [0.0000]***	11.47 [0.0007]***	4.97 [0.0833]*	4.84 [0.0278]**	5.15 [0.0761]*	5.02 [0.0251]**	3.07 [0.2155]	0.37 [0.5428]	48.96 [0.0000]***
Spec. food retailing (NACE 522)	NB00	0.95 [0.6214]	0.00 [0.9820]	0.49 [0.7811]	0.00 [0.9930]	0.19 [0.9072]	0.00 [0.9959]	0.72 [0.6989]	0.00 [0.9655]	5.14 [0.7425]
	ND00	13.88 [0.0010]***	2.04 [0.1535]	3.41 [0.1817]	3.21 [0.0730]*	1.52 [0.4683]	1.23 [0.2667]	0.37 [0.8325]	0.06 [0.7988]	24.71 [0.0017]***
Restaurants (NACE 553)	NB00	16.08 [0.0003]***	10.43 [0.0012]***	0.06 [0.9714]	0.06 [0.8096]	1.96 [0.3749]	0.22 [0.6410]	0.28 [0.8697]	0.27 [0.6033]	39.44 [0.0000]***
	ND00	19.66 [0.0001]***	19.57 [0.0000]***	0.38 [0.8278]	0.26 [0.6127]	8.37 [0.0153]**	8.37 [0.0038]***	6.60 [0.0368]**	0.03 [0.8591]	454.90 [0.0000]***
Bars & coffee-houses (NACE 554)	NB00	14.88 [0.0006]***	12.80 [0.0003]***	3.07 [0.2153]	1.70 [0.1922]	8.62 [0.0134]**	0.23 [0.6325]	9.89 [0.0071]***	6.19 [0.0128]**	29.96 [0.0002]***
	ND00	21.29 [0.0000]***	14.72 [0.0001]***	0.43 [0.8048]	0.28 [0.5945]	5.09 [0.0786]*	1.01 [0.3145]	1.96 [0.3760]	0.00 [0.9776]	42.08 [0.0000]***
										$\chi^2(4)$
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	38.04 [0.0000]***	38.02 [0.0000]***			0.08 [0.9611]	0.00 [0.9881]			41.08 [0.0000]***
	ND00	46.57 [0.0000]***	44.40 [0.0000]***			2.11 [0.3487]	1.28 [0.2570]			48.15 [0.0000]***

[ ] : Prob-value (p.v.) of H<sub>0</sub> ; : p. v. ≤ 10% ; : p. v. ≤ 5% ; : p. v. ≤ 1%.

Table IX. Joined tests (median low pop. density and high pop. growth, n=180)

Sector i	Dep. Var.	H <sub>0</sub> : RB, RD=0 $\chi^2(2)$	H <sub>0</sub> : RB+RD=0 $\chi^2(1)$	H <sub>0</sub> : RBc, RDc=0 $\chi^2(2)$	H <sub>0</sub> : RBc+RDc=0 $\chi^2(1)$	H <sub>0</sub> : RBP, RDP=0 $\chi^2(2)$	H <sub>0</sub> : RBP+RDP=0 $\chi^2(1)$	H <sub>0</sub> : RBPc, RDPc=0 $\chi^2(2)$	H <sub>0</sub> : RBPc+RDPc=0 $\chi^2(1)$	Global specification $\chi^2(8)$
Trade of motor vehicles (NACE 501)	NB00	3.77 [0.1518]	3.31 [0.0687]*	0.35 [0.8393]	0.22 [0.6413]	11.99 [0.0025]***	6.52 [0.0106]**	0.36 [0.8356]	0.22 [0.6393]	34.36 [0.0000]***
	ND00	0.41 [0.8157]	0.00 [0.9817]	5.43 [0.0663]*	0.02 [0.8894]	5.36 [0.0684]*	3.02 [0.0821]*	3.59 [0.1663]	0.11 [0.7439]	14.04 [0.0808]*
Repair of motor vehicles (NACE 502)	NB00	5.33 [0.0694]*	0.03 [0.8529]	0.14 [0.9337]	0.08 [0.7806]	0.17 [0.9174]	0.02 [0.8747]	0.82 [0.6624]	0.56 [0.4551]	6.20 [0.6248]
	ND00	1.48 [0.4770]	0.93 [0.3347]	1.94 [0.3798]	0.63 [0.4269]	0.90 [0.6383]	0.74 [0.3888]	0.68 [0.7100]	0.01 [0.9091]	5.09 [0.7481]
Unspecial. retailing trade (NACE 521)	NB00	1.12 [0.5721]	0.99 [0.3193]	9.43 [0.0090]***	1.52 [0.2170]	4.16 [0.1251]	0.01 [0.9036]	0.65 [0.7231]	0.15 [0.7013]	28.28 [0.0004]***
	ND00	7.15 [0.0280]**	0.58 [0.4476]	2.10 [0.3503]	0.25 [0.6195]	8.52 [0.0141]**	2.75 [0.0974]*	1.97 [0.3732]	1.89 [0.1689]	83.77 [0.0000]***
Spec. food retailing (NACE 522)	NB00	1.78 [0.4100]	1.76 [0.1851]	4.82 [0.0899]*	1.89 [0.1691]	4.61 [0.0997]*	4.46 [0.0348]**	0.79 [0.6744]	0.50 [0.4778]	12.62 [0.1257]
	ND00	7.50 [0.0235]**	0.24 [0.6260]	0.53 [0.7684]	0.00 [1.0000]	1.34 [0.5108]	1.06 [0.3042]	0.41 [0.8130]	0.21 [0.6455]	10.91 [0.2066]
Restaurants (NACE 553)	NB00	7.35 [0.0253]**	5.26 [0.0219]**	0.97 [0.6152]	0.04 [0.8357]	0.07 [0.9650]	0.01 [0.9299]	1.13 [0.5672]	1.06 [0.3027]	13.40 [0.0988]*
	ND00	12.33 [0.0021]***	9.86 [0.0017]***	4.89 [0.0869]*	3.94 [0.0470]**	2.94 [0.2305]	2.64 [0.1042]	4.95 [0.0843]*	3.55 [0.0596]*	23.85 [0.0024]***
Bars & coffee-houses (NACE 554)	NB00	9.95 [0.0069]***	9.84 [0.0017]***	3.44 [0.1793]	3.37 [0.0663]*	3.99 [0.1358]	1.44 [0.2304]	1.69 [0.4289]	0.43 [0.5112]	19.99 [0.0104]**
	ND00	9.82 [0.0074]***	9.82 [0.0017]***	6.95 [0.0310]**	3.90 [0.0483]**	2.32 [0.3136]	2.25 [0.1339]	2.68 [0.2614]	0.32 [0.5744]	26.10 [0.0010]***
										$\chi^2(4)$
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	16.47 [0.0003]***	15.85 [0.0001]***			0.85 [0.6551]	0.57 [0.4492]			16.69 [0.0022]***
	ND00	16.38 [0.0003]***	16.17 [0.0001]***			0.50 [0.7787]	0.47 [0.4920]			17.87 [0.0013]***

[ ] : Prob-value (p.v.) of H<sub>0</sub> ; : p. v. ≤ 10% ; : p. v. ≤ 5% ; : p. v. ≤ 1%.

Table X. Joined tests (median high pop. density and low pop. growth, n=180)

Sector i	Dep. Var.	H <sub>0</sub> : RB, RD=0 $\chi^2(2)$	H <sub>0</sub> : RB+RD=0 $\chi^2(1)$	H <sub>0</sub> : RBc, RDC=0 $\chi^2(2)$	H <sub>0</sub> : RBc+RDC=0 $\chi^2(1)$	H <sub>0</sub> : RBP, RDP=0 $\chi^2(2)$	H <sub>0</sub> : RBP+RDP=0 $\chi^2(1)$	H <sub>0</sub> : RBPc, RDPc=0 $\chi^2(2)$	H <sub>0</sub> : RBPc+RDPc=0 $\chi^2(1)$	Global specification $\chi^2(8)$
Trade of motor vehicles (NACE 501)	NB00	6.21 [0.0449]**	5.56 [0.0184]**	1.12 [0.5717]	1.12 [0.2909]	3.09 [0.2137]	0.01 [0.9210]	14.42 [0.0007]***	14.14 [0.0002]***	27.57 [0.0006]***
	ND00	12.01 [0.0025]***	11.27 [0.0008]***	6.30 [0.0429]**	5.51 [0.0189]**	12.52 [0.0019]***	0.56 [0.4544]	6.38 [0.0411]**	1.15 [0.2826]	194.52 [0.0000]***
Repair of motor vehicles (NACE 502)	NB00	1.64 [0.4396]	0.83 [0.3620]	7.73 [0.0209]**	7.24 [0.0071]***	8.17 [0.0168]**	4.22 [0.0400]**	8.76 [0.0125]**	7.52 [0.0061]***	25.33 [0.0014]***
	ND00	14.81 [0.0006]***	10.61 [0.0011]***	20.42 [0.0000]***	14.81 [0.0001]***	3.31 [0.1914]	0.03 [0.8611]	2.00 [0.3688]	0.13 [0.7224]	45.78 [0.0000]***
Unspecial. retailing trade (NACE 521)	NB00	16.03 [0.0003]***	12.56 [0.0004]***	11.07 [0.0040]***	8.36 [0.0038]***	8.88 [0.0118]**	2.27 [0.1321]	0.09 [0.9577]	0.02 [0.8829]	102.59 [0.0000]***
	ND00	3.49 [0.1743]	2.32 [0.1275]	0.25 [0.8831]	0.24 [0.6219]	0.73 [0.6927]	0.65 [0.4188]	0.25 [0.8838]	0.00 [0.9871]	586.57 [0.0000]***
Spec. food retailing (NACE 522)	NB00	9.36 [0.0093]***	8.36 [0.0038]***	7.58 [0.0226]**	5.36 [0.0206]**	1.19 [0.5516]	1.14 [0.2857]	4.65 [0.0977]*	1.90 [0.1681]	41.52 [0.0000]***
	ND00	14.72 [0.0006]***	3.31 [0.0689]*	5.36 [0.0687]*	5.35 [0.0207]**	0.48 [0.7871]	0.44 [0.5052]	3.73 [0.1553]	1.18 [0.2767]	25.76 [0.0012]***
Restaurants (NACE 553)	NB00	20.73 [0.0000]***	7.97 [0.0048]***	7.04 [0.0296]**	5.76 [0.0164]**	1.08 [0.5841]	1.01 [0.3145]	2.33 [0.3126]	0.02 [0.8782]	52.31 [0.0000]***
	ND00	18.92 [0.0001]***	17.09 [0.0000]***	0.89 [0.6421]	0.89 [0.3466]	0.90 [0.6391]	0.89 [0.3454]	2.44 [0.2946]	0.06 [0.8125]	42.31 [0.0000]***
Bars & coffee-houses (NACE 554)	NB00	16.70 [0.0002]***	13.43 [0.0002]***	3.01 [0.2223]	0.05 [0.8220]	1.58 [0.4528]	1.56 [0.2116]	0.81 [0.6685]	0.80 [0.3697]	29.76 [0.0002]***
	ND00	15.33 [0.0000]***	12.32 [0.0004]***	19.53 [0.0001]***	15.87 [0.0001]***	2.26 [0.3237]	1.30 [0.2533]	1.87 [0.3920]	1.17 [0.2786]	51.29 [0.0000]***
										$\chi^2(4)$
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	120.66 [0.0000]***	120.08 [0.0000]***			2.67 [0.2638]	0.97 [0.3258]			122.47 [0.0000]***
	ND00	74.32 [0.0000]***	74.21 [0.0000]***			1.44 [0.4873]	1.32 [0.2502]			76.45 [0.0000]***

[ ] : Prob-value (p.v.) of H<sub>0</sub> ; : p. v. ≤ 10% ; : p. v. ≤ 5% ; : p. v. ≤ 1%.

Table XI. Joined tests (median low pop. density and low pop. growth, n=114)

Sector i	Dep. Var.	H <sub>0</sub> : RB, RD=0 $\chi^2(2)$	H <sub>0</sub> : RB+RD=0 $\chi^2(1)$	H <sub>0</sub> : RBc, RDc=0 $\chi^2(2)$	H <sub>0</sub> : RBc+RDc=0 $\chi^2(1)$	H <sub>0</sub> : RBP, RDP=0 $\chi^2(2)$	H <sub>0</sub> : RBP+RDP=0 $\chi^2(1)$	H <sub>0</sub> : RBPc, RDPc=0 $\chi^2(2)$	H <sub>0</sub> : RBPc+RDPc=0 $\chi^2(1)$	Global specification $\chi^2(8)$
Trade of motor vehicles (NACE 501)	NB00	4.74 [0.0937]*	4.17 [0.0411]**	6.36 [0.0416]**	5.00 [0.0253]**	20.23 [0.0000]***	15.92 [0.0001]***	14.54 [0.0007]***	0.96 [0.3261]	77.00 [0.0000]***
	ND00	288.28 [0.0000]***	4.98 [0.0257]**	0.44 [0.8020]	0.21 [0.6480]	2.57 [0.2771]	0.00 [0.9910]	0.87 [0.6472]	0.50 [0.4812]	533.95 [0.0000]***
Repair of motor vehicles (NACE 502)	NB00	1.33 [0.5143]	0.29 [0.5895]	5.45 [0.0656]*	2.59 [0.1073]	1.33 [0.5144]	0.39 [0.5312]	1.55 [0.4618]	0.46 [0.4966]	9.61 [0.2934]
	ND00	3.49 [0.1743]	0.01 [0.9121]	1.88 [0.3913]	1.82 [0.1772]	7.00 [0.0302]**	6.99 [0.0082]***	5.36 [0.0685]*	3.53 [0.0603]*	76.52 [0.0000]***
Unspecial. retailing trade (NACE 521)	NB00	2.26 [0.3225]	2.24 [0.1348]	0.09 [0.9547]	0.03 [0.8663]	2.87 [0.2385]	1.31 [0.2519]	4.67 [0.0968]*	4.56 [0.0327]**	10.51 [0.2309]
	ND00	65.97 [0.0000]***	0.06 [0.8056]	0.70 [0.7031]	0.18 [0.6702]	0.73 [0.6957]	0.00 [0.9659]	0.24 [0.8868]	0.21 [0.6498]	444.89 [0.0000]***
Spec. food retailing (NACE 522)	NB00	0.85 [0.6542]	0.01 [0.9036]	3.20 [0.2023]	0.56 [0.4549]	3.06 [0.2164]	0.17 [0.6822]	2.18 [0.3357]	0.82 [0.3642]	10.91 [0.2067]
	ND00	30.42 [0.0000]***	0.31 [0.5804]	1.23 [0.5401]	0.61 [0.4357]	4.02 [0.1343]	0.03 [0.8659]	5.21 [0.0740]*	0.74 [0.3886]	64.38 [0.0000]***
Restaurants (NACE 553)	NB00	11.63 [0.0030]***	7.40 [0.0065]***	5.62 [0.0601]*	2.96 [0.0851]*	5.05 [0.0801]*	3.49 [0.0619]*	3.48 [0.1751]	1.74 [0.1873]	52.83 [0.0000]***
	ND00	9.93 [0.0070]***	2.23 [0.1350]	0.12 [0.9409]	0.03 [0.8538]	4.90 [0.0862]*	0.07 [0.7867]	1.33 [0.5154]	0.58 [0.4462]	31.72 [0.0001]***
Bars & coffee-houses (NACE 554)	NB00	4.30 [0.1166]	2.92 [0.0875]*	1.52 [0.4680]	0.00 [0.9691]	0.24 [0.8876]	0.03 [0.8687]	0.46 [0.7944]	0.42 [0.5146]	8.22 [0.4124]
	ND00	15.00 [0.0006]***	1.48 [0.2231]	7.17 [0.0277]**	2.20 [0.1384]	0.65 [0.7217]	0.51 [0.4741]	0.96 [0.6191]	0.90 [0.3428]	22.28 [0.0044]***
										$\chi^2(4)$
Total (NACE 501, 502, 521, 522, 553, 554)	NB00	4.73 [0.0937]*	1.49 [0.2217]			0.07 [0.9662]	0.00 [0.9913]			4.74 [0.3146]
	ND00	10.70 [0.0047]***	8.83 [0.0030]***			1.81 [0.4049]	0.73 [0.3940]			11.74 [0.0194]**

[ ] : Prob-value (p.v.) of H<sub>0</sub> ; : p. v. ≤ 10% ; : p. v. ≤ 5% ; : p. v. ≤ 1%.