Does disaggregation matter in job creation and destruction flows?

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March, 2005
Preliminary Version

Abstract
The paper investigates the changes in job creation and destruction flows when we consider a more disaggregate level of analysis. If institutional setup plays a more important role, compared to other factors, then at lower level of aggregation we should observe job flows regularities in line with national ones. Using a unique database on the firm population in Trentino (a North-Eastern Province of Italy) from 1991 to 2001, we analyse the characteristics of a local labour market and compare them with the national ones. We find that: (a) job flows shows a "fractal" nature, i.e. many regularities appear to be scale invariant (magnitude of flows and their persistence). In particular job flows magnitude is in line with average values of Italy; (b) there exist some qualifications to "fractality": entrant firms’ contribution to job creation process is lower than the corresponding contribution at national level. Whereas, job destruction share accounted for by exit firms is around 30% in line with stylized facts; (c) size and age shape the job flows; (d) between macro sectors shifts of jobs are rare.

Keywords: Labor reallocation, job flows, sample selection, firms’ distribution.

JEL-Codes: C34, J23, L11.

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1 Introduction

One of the questions that arises studying job creation and destruction flows is related with their pervasivity and their capacity of replicating regular patterns at different levels of analysis. Using a new database (DM10TN) with data collected by INPS\(^1\) (the Italian Social Security Institution) and by the local bureau of ISTAT\(^2\) (National Statistics Institute), we explore a regional labor market with a particular emphasis on job flows dynamics. The analysis can be considered a paradigmatic example of a local labor market analysis, which is based on “genuine” microdata obtained from the direct observation of the units of analysis (firms) on the field without any filter or extrapolation from national data.

The paper investigates how job creation and destruction flows change if we consider a more disaggregate level of analysis. The issue is particularly important once we recognize as determinants of job flows institutional setups and/or idiosyncratic characteristics of firms. We can expect that if institutional setup plays a more important role, compared to other factors, then at lower level of aggregation we should observe job flows regularities in line with national ones. In other words, we could say that job flows regularities posses a “fractal” nature (Blanchflower, 1994). To be more precise one can ask what are the regularities that, eventually, are maintained descending to a lower level of analysis. Moreover, it is interesting to investigate if the labor supply tightness of a local labor market can alter job flows.

The empirical and theoretical literature has often highlighted the importance of the analysis of job flows (Davis et al., 1996). The general picture that emerges shows how labor markets are continually shaped by phenomena of creation and destruction of jobs. The magnitude of job flows is crucial for alternative theories of unemployment and salaries determination. On one side, the large size of job flows in the United States has enhanced theories that model unemployment as a frictional phenomenon (Pissarides, 2000). The geographical dispersion of jobs as well as the heterogeneity of the available skills with regard to firm requirements is, among others, a source of frictions in the labour market. On the other side, the persistence of job flows in the labour market limits the validity of theories based on the contraposition of different groups of employed (insiders) and unemployed (outsiders) in order to explain the existence of persistent positive unemployment rates in the economy.

The empirical studies on gross job flows represent an important

\(^1\)INPS stands for Istituto Nazionale della Previdenza Sociale.  
\(^2\)ISTAT: Istituto Nazionale di Statistica.
step in the analysis of the employment dynamics at the firm/plant level. Davis and Haltiwanger (1999) find that the largest job flows characterize the youngest firms/plants. Their result establishes a solid relationship among the firm age and the firm heterogeneity. Furthermore, it supplies empirical evidence for the importance of the selections effects in the evolution of industries (Dosi et al., 1995). In addition, the great magnitude of job flows shows the limits of modelling industrial dynamics using representative firms. The relevant and persistent heterogeneity of firms implies that the aggregation processes function as smoothing mechanisms of the asymmetries and non-linearities of the employment dynamics at the firm level.

Olley and Pakes (1992) and Baily et al. (1996) show that the reallocation of jobs and productive inputs from less efficient to more efficient firms explain a large fraction of the productivity gains at the industry level. More generally, job flows data are very useful in analysing the relationship between the reallocation process and the productivity and salary growth.

Finally, job flows supply a good instrument for investigating the nature of business cycle and its relation with the reallocation of jobs and employees. Different phases of business cycles are characterized by different degree of creation and destruction, but even if we observe an expansion (contraction) of the economy job destructions (creations) are still present. We do observe contemporaneous creations and destructions that demonstrate the importance of heterogeneity of firms in labor market and of underlining selection processes (Davis et al., 1996).

We use an original database, DM10TN, to address some of the most important questions about local labor market functioning. The database collects observations on employees and on demographic aspects of the population of firms active in Trentino during the period 1991-2001. It provides monthly data on all the sectors in the economy, including manufacturing, construction and services. In particular, we study the magnitude of job flows, their stability and cyclicity over the period under analysis. We propose different level of disaggregations in order to disentangle sectoral dynamics, the role of firm size in shaping flows, and the role of firm age in changing labor market dynamics. Then, we analyze the role of firms’ entry and exit processes and their contribution to job flows and labor market dynamics. Finally, an analysis of structural determinants of job creations and destructions is conducted.

The analysis revealed a sort of “scale invariant” nature of job flows for many aspects, as suggested by many researchers (cf. Faggio and Konings (2003), Stahl et al. (2002) and Barnes and Haskel (2002)).
In fact, the study shows the role of institutional factors in governing job flows at local level that are in line with Italian average values. Nevertheless, at local level some of the national level patterns are not reproduced. In particular, magnitude of job flows presented by incumbent firms is in line with national level, whereas the role of entrant firms appears to be lower at local level. Sectoral patterns of job flows are reproduced at local level, whereas, the degree of between sectors shifts of jobs is reduced. Results on persistence of job flows reveal that the majority of jobs created and destroyed represents permanent changes of employment levels for firms as it emerges for Italian job creations and destructions. The structural analysis of the determinants of job flows shows that observable heterogeneity explain part of the variance in job creations and destructions, even if unobservable heterogeneity plays a role.

The paper is structured as follows: section 2 and 3 describe respectively the data and the methodology, while section 4 presents the results. Section 5 concludes.

2 The data

2.1 Source of the data and structure of the panel DM10TN

The data used in the analysis come from DM/10 forms presented by employers with the residence in the province of Trento every month to INPS. The DM/10 model concerns all the firms with at least one employee and has monthly cadence\(^3\). The data are physically collected by local INPS office and the local ISTAT office of Provincia Autonoma di Trento (PAT) that provide the expertise to treat the resulting database and to perform preliminary elaborations\(^4\).

Data available are organized in a series of yearly data sheets for a period going from 1991 to 2001. A single record in these tables regards a social security declaration of an employer with at least one employee with residence in the province of Trento. The survey covers the universe of employers with residence in the province of Trento for the period under analysis. There are two remarks to make about the coverage: (a) The data are missing for the year 1997 and for some months in other years; (b) There is a neglectable reduction in the population size due to errors in the data collection or/and in the

\(^3\)Details about DM/10 model can be found in Gallo (2003).
\(^4\)We would like to thank Giampaolo Sassudelli for the support provided at early steps of database creation.
inputations/transcriptions of data sheets into the database.

As we noted above the original database was composed by records regarding monthly social security registrations of employers. We rearranged the data in order to modify the unit of observation. The structure of survey allows employers to span their social security registrations on more than one record, given the different ATECO2002 sector in which she employs the workers. Hence, we grouped records corresponding to the same firm into a single record looking at legal ID of employer linked to each observation. The resulting database refers to "firms" identifiable through their legal ID. Moreover, we merge the yearly files into a panel in which all the information are collected.

The panel is composed by around 24000 observations per year and the variables are divided into two groups: the first one with demographic information about firms and the second one containing the information about the employees of these firms.

The demographic section gives us the following information about firms: id, ATECO2002 code (5 digits), day, month and year of entry into the data sheets, date of exit from the database, the age (month of activity).

The second part of database contains the following monthly variables for every firm: number of employees, job creations and destructions, job creation and destruction rates, net employment gains, net employment rates of change, total job reallocation and excess job reallocation, job reallocation and excess job reallocation rates.

We also calculated annual averages for the above variables and we grouped age and size into classes\(^5\).

### 2.2 Data correction

Data suffer a break for the year 1997 due to the changes in the Italian law concerning privacy. As a result, for that year ISTAT did not diffuse any data.

We checked for missing data and we investigate data to discover eventual "typical" errors, namely records duplication and misspelled units of measurement. We found a small negligible number of duplicated records that we deleted. The filtering procedure to correct records with missing data reveal that for 316 records there were no legal ID of firm and/or the ATECO code. This was basically due to errors in data collection. The analysis of these records revealed that they were distributed randomly, so we deleted them without the risk of altering sectoral distributions \(^6\).

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\(^5\)A detailed definition and a discussion about the size and age classes is provided below.

\(^6\)Note that ISTAT local office performed a procedure for filtering data \textit{ex-ante}, this fact
The transformation of unit of analysis, we recalled above, from "social security registration of employer" to "firm" was done using the legal ID of firms as a key that links each single registration to the corresponding legal entity. The ATECO2002 code was assigned to each firm looking at its prevalent activity that was individuated by the sector in which the firm employed the higher number of workers.

2.3 Methodology

2.3.1 Basic definitions

The analysis of job destructions and creations uses many definitions and conventions that are currently well grounded into the literature dealing with flows in labor market. In particular, the pioneering work of Davis et al. (1996) provides the guidelines for job flows analysis. In the following we conform to this methodology.

A preliminary remark regards the non availability of microdata suited to measure directly the flows of jobs into and among firms, where a job is defined as an employment position filled by a worker\(^7\). As a consequence, we employ a methodology that provides us an estimation of the number of jobs created and destroyed in a period of time.

The capacity of an economy to generate jobs can be measured by looking at employment level changes that occur in an interval of time.

The standard way to measure jobs created in a firm is to look at the number of employees. The creations in a sector \(I\) at time \(t\) is defined by the employment gains in expanding firms plus the employees of the new entrant firms:

\[
JC_{It} = \sum_{i \in S_I^+} (N_{it} - N_{it-1}) + \sum_{i \in E_{It}} N_{it},
\]

in which: \(JC_{It}\) is the job creations at time \(t\) in sector \(I\); \(S_I^+\) is the set of the expanding firms; \(E_{It}\) is the set of the newcomers into the sector at time \(t\).

Similarly we measure job destructions at time \(t\) as the sum of the absolute value of losses in the employment level of firms in the sector

\(^7\)In literature there exist some studies that make ‘direct’ observations on job flows. They are only small sample data collections and refer to a limited geographical region and for a limited period of time. One of these examples is the IDA database in which is collected information about Danish economy. More information about it can be found in the Denmark statistic website at the address: http://www.dst.dk/HomeUK/Guide/Varedeklarationer/emnegruppe/. Another branch of literature deals with matched data employer-employees, cf. Abowd and Kramarz (1999).
and the losses of employees due to exits of firms from that sector $(X_{It})$:

$$JD_{It} = \sum_{i \in S^-_t} |N_{it} - N_{it-1}| + \sum_{i \in X_{It}} N_{it-1}. \quad (2)$$

Once the level of job creation and destruction has been defined, we can calculate their growth rates. These rates can be obtained by dividing job creation and destruction levels by a measure of sector size. To start with, we define the size of a firm $i$ as the average size in period $(t, t-1)$: $Z_{it} = \frac{1}{2}(N_{it} + N_{it-1})$, and the correspondent employment growth rate is given by:

$$g_{it} = \frac{\Delta N_{it}}{Z_{it}}. \quad (3)$$

Note that the growth rate is bounded in $[-2, 2]$ and behaves symmetrically in contractions and expansions\(^8\). Sectoral rate of job creation can be written as:

$$jc_{It} = \sum_{i \in S^+, i \in E_{It}} \frac{Z_{it}}{Z_{It}} g_{it} = \frac{JC_{It}}{Z_{It}}. \quad (4)$$

Similarly the job destruction sectoral rate is given by:

$$jd_{It} = \sum_{i \in S^-, i \in X_{It-1}} \frac{Z_{it}}{Z_{It}} |g_{it}| = \frac{JD_{It}}{Z_{It}}. \quad (5)$$

Equations 4 and 5 show that sectoral rates of creation and destruction can be obtained through a weighted average of individual growth rates weighted with employment shares. Other important definitions are:

- The **net employment growth rate**: $net_{It} = jc_{It} - jd_{It}$, which gives us the net change in employment level as a result of the job creation and destruction activities;

- the **total job reallocation**: $jr_{It} = jc_{It} + jd_{It}$, which is a measure of the degree of gross “activity” of labor market;

- the **excess job reallocation**: $xjr_{It} = jr_{It} - |net_{It}|$, which provides an indicator of the labor market capacity to reallocate jobs once we clear for the effect of growth.

\(^8\)Note that the usual measure is bounded in $[-1, +\infty)$ and shows non-symmetric reactions to expansions and contractions.
It is worthwhile to note that the total job reallocation measures the overall capacity to create and destroy jobs of the system. Whereas the excess job reallocation provides a measure of the job changes necessary to accommodate changes in employment.

All the measures introduced above can be calculated at system level - i.e. for the whole economy- with a natural extension of the meanings. It is possible to calculate the above rates for subsets of the economy obtained through different disaggregation directions, namely age, size and regions. The above definitions apply directly.

2.4 The regression analysis

A second group of results is obtained through a regression analysis aiming to quantify the influence of structural determinants of job creation and destruction flows.

The first strategy is related with the so called separate regressions that we briefly introduce: we divided firms into two groups: expanding firms and contracting firms, then, we estimated a linear regression using as dependent variable the rate job creation on the first group, and the rate of job destruction on the second.

However, such procedure produces biased estimations of the parameters given that it could be present a selection bias in the data. More specifically, each firm in a year can be in three different states: expansion, contraction and inaction, depending on the sign of its net employment change. Such subdivision is endogenous respect to firm’s characteristics, i.e. firms can be self-selected by their characteristics into one of the three groups. To correct such bias, and consequently correct estimation results, we use an alternative econometric model: a modified two stages Heckman estimator (HMM) that generates consistent estimations of parameters.

We consider three latent variables \((jc^*_i, jd^*_i, I^*_i)\) for which it is possible to write the following equations:

\[
\begin{align*}
jc^*_i &= x_i' \beta_{jc} + u_{i,jc} \\
jd^*_i &= x_i' \beta_{jd} + u_{i,jd} \\
I^*_i &= z_i' \gamma + \epsilon_i
\end{align*}
\]

\(x_i\) is an array containing all the explanatory variables, \(z_i\) is an array of variables that are used to select firms. Equation 6 is the job creation equation; equation 7 is the job destruction equation and 8 represents the self selection equation.
We define $w_i$ as the whole set of explanatory variables contained in $x_i$ and $z_i$. Let $v_i = (u_{i,jc}, u_{i,jd}, \epsilon_i)$. Finally we assume:

$$v_i | w_i \sim N(0, \Sigma)$$ (9)

in which, the elements of conditional variance-covariance matrix $\Sigma$ are allowed to be nonzero. Note that the above hypothesis synthesizes the endogeneity of selection. Our problem can be rewritten as follow:

$$J_i = \begin{cases} 
jc_i & \text{if } I_i^* > \mu^+ \\
0 & \text{if } \mu^- < I_i^* < \mu^+ \\
jd_i & \text{if } I_i^* < \mu^-
\end{cases}$$ (10)

in which $\mu^-$ and $\mu^+$ represents the thresholds entailed in self selection equation 8 that allows firms to change job flow status.

Moreover, we do not fully observe $I_i^*$, we have information about the variable $I_i$ that signals its sign:

$$I_i = \begin{cases} 
1 & \text{if } I_i^* > \mu^+ \\
0 & \text{if } \mu^- < I_i^* < \mu^+ \\
-1 & \text{if } I_i^* < \mu^-
\end{cases}$$ (11)

In these assumptions it can be shown that we can write expectation of $jc_i$ conditional on: (a) dependent variables $x_i$, (b) an additional term representing the self-selection:

$$E[(J_i|w_i, I_i^*) > \mu^+] = x_i'\beta_{jc} + E(u_{jc,i}|w_i, I_i^*) = x_i'\beta_{jc} + \frac{\sigma_{1,\epsilon}}{\sigma_\epsilon} \cdot \lambda(\mu^- - \frac{z_i'\gamma}{\sigma_\epsilon})$$ (12)

Where $\lambda(.)$ is the inverse Mills’ ratio calculated in the point: $\frac{\mu^+ - z_i'\gamma}{\sigma_\epsilon}$. Similarly we can write the expression for conditional expectation of job destructions $jd_i$:

$$E[J_i|w_i, I_i^*) < \mu^-] = x_i'\beta_{jd} + E(u_{jd,i}|w_i, I_i^*) = x_i'\beta_{jd} + \frac{\sigma_{2,\epsilon}}{\sigma_\epsilon} \cdot \lambda^*(\mu^- - \frac{z_i'\gamma}{\sigma_\epsilon})$$ (13)

where $\lambda^*(.)$ is the complement of the Mills’ ratio calculated in the point: $\frac{\mu^- - z_i'\gamma}{\sigma_\epsilon}$.

From equations 12 and 13 we derive a more appropriate functional form to employ for our analysis: two augmented regressions for job creation and destruction, in which are present, respectively, the Mill’s ratio and its complement as additional explanatory variables. The joint estimation of these regressions can be done using a
slightly modification of Heckmann two stages procedure. The standard Heckmann procedure is composed by a first stage in which a ordered probit model with two possible outcomes for independent variable is estimated through a maximum likelihood criterion. From this preliminary estimation it is possible to obtain an estimation of Mills’ ratio. The second step consists of a regression in which is included the Mills’ ratio as regressor using the standard OLS estimator\(^9\).

The modification we used implies the estimation of an ordered probit with three possible outcomes at first step instead of only two. The independent variable is represented by the selectivity term \(I_i\) - indicating the sign of the net employment change-, which as we noted above can assume three values: -1, 0, 1. The result of the probit estimation provides a consistent estimation of both the Mills’ ratio and its complement. We use such estimations in a second step in which augmented regressions are estimated via OLS\(^10\).

Given the number of variables available we run the two stages using the same set of independent variables, this could raise a issue of identification of the system we estimate at the second stage. In this respect it is important to note that the non-linearity of Mills’ ratio -and of its complements- together with the assumption of linearity of second step functional forms ensure the identification of the system, cf. Maddala (1985).

3 Results

3.1 Employment dynamics in Trentino during the period 1991-2001

A descriptive analysis of the evolution of employment is conducted to shed light both on the data available and on the framework in which we are going to conduct our analysis of job flows. Figure 1 presents monthly number of employees in the three macro-sectors and for the whole local economy.

The level of total employment in the period under analysis is stable until 1996 and presents an upwards trend starting from 1998\(^11\). From 1991 to 2001 the total number of employees increases from around

\(^9\)For details about the procedure see Greene (2003), p.784-787.

\(^10\)See Frazis (1993) for an application of the same procedure on the study of degree effects on performances of a group of students. Alonso-Borrego and Collado (2001) apply the method to study the role of innovation in job creation and destruction flows.

\(^11\)We recall that we do not have data for the period from january 1997 to december 1997.
70,000 units to around 80,000. The main contribution to employment growth has to be accounted to services, while construction and manufacturing show a substantial stability. In particular manufacturing suffered recession during the 1996-1998 showing negative peaks at the end of those years. A pervasive characteristic of the data is their seasonality. In particular services and construction show high monthly variability within a year. The highest number of employees is reached in all macrosectors in September while a negative peak can be found in correspondence of November. Services present the higher seasonality. Moreover, we observe an upward trend for services and construction starting from 1998 and a parallel increase in their percentage contribution to overall employment.

3.2 Magnitude of flows

We begin our analysis looking at aggregate rate of creation and destruction over the window available. The first question we address is if in a local labor market we can observe job flows phenomena of a comparable magnitude. Table 1 shows the average values of flow rates for Italy, some European countries and for Trentino. The results of the comparison are interesting: Trentino shows flows of creation and
destruction of magnitude similar to cross-country patterns. Reallocation rate for Trentino is around 22% and is in line with results for Italy. We underline that the shortage of available data do not allow to make comparisons over the same time window. In particular, only recently INPS produces data until 1998 for Italy, but no studies have been conducted on them.

An additional information we can derive from the table is the contribution of entry firms to job creation process and of exitors to job destruction. Trentino entrant firms are under the average contributions of European countries and in particular they result to be under the national average value: one fifth of job creation rate is explained by entrants in Trentino while the percentage for Italy raises to a half. Regarding exits contributions Trentino firms present a job destruction rate in line with the other presented in the table.

An analysis of the evolution along the years of flows structure is provided in figure 2 which accounts for yearly average job creation and job destruction rates, and for net employment changes for the whole economy -aggregation of the three macrosectors we consider. In the figure we reported also the GDP growth rate for the years 1992-2001. Cyclical features of job creation and destruction seem to be confirmed. Job creation moves pro-cyclically and job destruction moves anti-cyclically. Net employment growth, calculated as the difference by yearly creation and destruction rates, is pro-cyclical too. We investigate also cyclical behaviors of macrosectors in figures 3, 4 and 5.

These figures confirm the cyclical patterns observed at aggregate level. Note that the break in data availability for 1997 distorts results for 1998 that appear to be not in line with the rest of the series. Services and construction show a negative trend for job destruction and a positive one for job creation. Manufacturing macrosector presents a stable pattern both for job creation and for job destruction rates.

These results confirm the existence of consistent simultaneous flows of creation and destruction along business cycle as a result of micro heterogeneity of behaviors, cf. Leombruni (2003).

### 3.3 Job flows and size of firms

The importance of small businesses emerges in literature from many studies (Barnes and Haskel, 2002; Davis and Haltiwanger, 1999; Picot and Dupuy, 1996). There exists evidence that small firms are more "active" than bigger firms in creating and destroying jobs.

Seminal studies on U.S. economy revealed that most of the net creation of jobs was due to small firms (Birch, 1987). Subsequent
<table>
<thead>
<tr>
<th>Countries</th>
<th>Time coverage</th>
<th>Job Creation rate</th>
<th>Job Destruction rate</th>
<th>Job Reallocation rate</th>
<th>Job Creation rate Entries</th>
<th>Incumbents</th>
<th>Job Destruction rate Incumbents</th>
<th>Exits</th>
<th>NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>1987-1992</td>
<td>9.00</td>
<td>7.50</td>
<td>16.50</td>
<td>2.50</td>
<td>6.50</td>
<td>5.60</td>
<td>1.90</td>
<td>1.50</td>
</tr>
<tr>
<td>France</td>
<td>1984-1991</td>
<td>12.70</td>
<td>11.80</td>
<td>24.40</td>
<td>6.10</td>
<td>6.60</td>
<td>5.50</td>
<td>6.30</td>
<td>0.90</td>
</tr>
<tr>
<td>Austria</td>
<td>1978-1998</td>
<td>8.90</td>
<td>8.90</td>
<td>17.9</td>
<td>3.10</td>
<td>5.80</td>
<td>6.00</td>
<td>3.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Sweden</td>
<td>1987-1995</td>
<td>11.2</td>
<td>12.1</td>
<td>23.30</td>
<td>3.10</td>
<td>5.80</td>
<td>10.40</td>
<td>1.70</td>
<td>-0.90</td>
</tr>
<tr>
<td>U.K.</td>
<td>1985-1991</td>
<td>8.70</td>
<td>14.60</td>
<td>23.30</td>
<td>2.70</td>
<td>6.00</td>
<td>9.60</td>
<td>5.00</td>
<td>2.10</td>
</tr>
<tr>
<td>Italy</td>
<td>1987-1992</td>
<td>11.00</td>
<td>10.00</td>
<td>21.00</td>
<td>3.80</td>
<td>7.20</td>
<td>6.20</td>
<td>3.80</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 1: The role of exits and entries in determining the flows: a cross-country comparison. *Source: authors’ own elaborations on data DM10TN, Stahl et al. (2002) and Leombruni (2003).*
Figure 2: Aggregate yearly job creation and destruction rates, net employment growth and rate of growth of GDP in Trentino over the years 1991-2001. *Authors’ own elaborations on database DM10TN, PAT (2001) and PAT (1998).*

Figure 3: Manufacturing macrosector’s yearly job creation and destruction rates, net employment growth and rate of growth of GDP in Trentino over the years 1991-2001. *Authors’ own elaborations on database DM10TN, PAT (2001) and PAT (1998).*
Figure 4: Construction macrosector’s yearly job creation and destruction rates, net employment growth and rate of growth of GDP in Trentino over the years 1991-2001. *Authors’ own elaborations on database DM10TN, PAT (2001) and PAT (1998)*

Figure 5: Services macrosector’s yearly job creation and destruction rates, net employment growth and rate of growth of GDP in Trentino over the years 1991-2001. *Authors’ own elaborations on database DM10TN, PAT (2001) and PAT (1998)*
analysis revealed that, even if the methodology used to measure the impact of small firms has to be slightly changed -see Davis et al. (1996), the proposition still holds. This observation has an important effect on the design of public policies, in particular it seems to be crucial when we focus the analysis on local labor market. In our case Trentino policies aimed for several years to enhance the entrepreneurial activity in the Province with different forms of incentives. In this respect, the main concern is related with the capacity of such interventions of generating and sustaining the process of growth of employment and of local economy. The analysis we propose tries to disentangle the role of small firms in generating new jobs.

The study of job creation and destruction for different firms’ size involves a subdivision of firms into size classes. Such operation utilizes a measure of firms’ size that is ”arbitrary” -in some senses; moreover, if the choice of a particular measure allows to underline phenomena of interest, it poses some limitations and can induce some distortions that we need to know.

Many authors pointed out a possible source of this class of distortions in organizing data about plant and firm into size classes using longitudinal data, namely the ”distribution fallacy”\(^\text{12}\). The distribution fallacy as noted by Davis et al. (1996) is related to the eventual migration of firms among size classes into which firms are subdivided. The bigger is the migration, the bigger is the overestimation of relative weight of small firms in creating or destroying jobs. The only conclusion we can draw is to be careful with the analysis of size distributions and job flows or growth rates of firms and to perform additional studies about the impact of small firms. Suppose that we estimate the size of firms in terms of number of employees for a set of years and that we create a set of size classes to group our yearly observations in order to simplify the interpretation of results. In these condition we can have distortion in results given by the distribution fallacy. The cause of the distortion is the migration of firms along the years form one size class to another. In addition the problem could be exacerbated by the temporary nature of these fluctuations.

Hence, the estimation of creations and destrucions for firms divided into size classes has to be done carefully and with the aim of reducing the eventual distortions. The problem can be reconducted to the choice of the right measure of firm size that is able to limit the distribution fallacy.

In literature there exist at least three different size’s measures to adopt using longitudinal data: (a) base year employment size; (b) current average size; (c) long run average size. The first method uses

\(^{12}\text{Cf. Baldwin et al. (1998), Barnes and Haskel (2002) and Davis et al. (1996).}\)
the base year employment of firms as a measure of the firm’s size. The current average size measure utilizes the average number of employees in two contiguous periods. The last measurement of size makes use of the average number of employees over a long period of time to smooth employment -and the consequent temporary migrations in the classes. The application of the methods revealed substantial changes in results and in the consequent interpretations. For example, studies on U.K. small firms show that using the average size method the rates of creations (destructions) accounted by small firms are sensibly lower (higher) than the corresponding estimations done using base year size (Barnes and Haskel (2002) table n.12).

We use long average size measure to analyze the role of size in shaping job flows. In particular, we consider long run average size as the average number of employees, where the average is computed referring to yearly employees for the period of time available. Table 2 reports the percentage contributions to job creations by each size class.

Small firms from 1 to 9 employees are responsible for the majority of creations and deaths in the system. With current average measure of size we find that 50% of creations and 71% of destruction are concentrated in this class. Other classes present shares of creations and deaths that do not exceed 14%. An additional clear pattern emerges from the table: contributions to job flows of classes decrease as we consider classes referring to bigger firms. In particular, job destructions seem to be more concentrated compared to job creations in classes accounting for smaller firms. Once we consider long run average measure of size instead of current average measure of size we find that the contribution of small firms to creations is exacerbated while their contribution to destruction is mitigated. The first class from 1 to 9 employees accounts for 60% of creations and for 59% of destructions.

The above results confirm the important contribute to flows dynamics due to smaller firms in absolute terms. An open question regards the relative capacity of creating and destroying jobs of smaller firms. One can argue that, even if their contribution to flows is high in Trentino economy, this fact can be accounted by the bias towards small firms that this local economy exhibit, but nothing can be concluded about the capacity of creating and destroying jobs of firms of different sizes. To disentangle the dynamic capacity of firms we calculated job creation and destruction rates for each class. Table 2 shows

\footnote{Note that the long average size method overcomes other problems like the measurements errors and the transitory shocks that can alter the size of firms -in particular of small firms (Davis et al., 1996).}
disaggregate rates of creation and destruction for size classes. The two different measures presented in the two sections of the table do not present significant differences related to patterns of job creation and destruction rates, but there emerge some differences in excess job reallocation rate and net employment growth. Both measures indicate that the smaller the size of firms the higher is the corresponding job creation and destruction rate. Reallocation rate for 1-9 employees class is around 36% and it decreases as we move towards bigger firms’ classes reaching its minimum value of 10%. The role played by small firms emerges more clear if we consider the excess job reallocation rates. A negative correlation between firms’ size and excess job reallocation is evident: small firms excess reallocation rate is around 32% and it declines with classes grouping bigger firms; reallocation rate for firms bigger than 500 employees reaches 9.6%. The size of firms matters respect to the capacity of reallocating jobs. Once we clear from distortions entailed in current average measure, considering the long average measure, we are able to reassess the capacity of growth of small firms. Average growth rate of employment on annual base is around 3% and small firms account for a rate of growth of around 5% for the first class, a value that is beyond the average. The growth rate declines with the size, the only exception is the class from 200 to 499 employees with a rate of 3.36%. The last result is in line with evidence presented by Picot and Dupuy (1996) for Canadian firms for the period 1978-92.

Figures 6 and 7 present, respectively, the percentage distribution
### current average size

<table>
<thead>
<tr>
<th>All Macrosectors</th>
<th>jc</th>
<th>jd</th>
<th>jr</th>
<th>xjr</th>
<th>net</th>
</tr>
</thead>
<tbody>
<tr>
<td>average values</td>
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<td>9.53</td>
<td>21.47</td>
<td>19.06</td>
<td>2.41</td>
</tr>
<tr>
<td>from 1 to 9 empl.</td>
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<tr>
<td>from 10 to 19</td>
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<td>17.48</td>
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<td>4.75</td>
</tr>
<tr>
<td>from 20 to 49</td>
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<td>15.47</td>
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<td>5.43</td>
</tr>
<tr>
<td>from 50 to 199</td>
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<td>4.54</td>
<td>13.42</td>
<td>9.09</td>
<td>4.33</td>
</tr>
<tr>
<td>from 200 to 499</td>
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<td>3.31</td>
<td>12.27</td>
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<td>500+</td>
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### long run average size

<table>
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<th>jr</th>
<th>xjr</th>
<th>net</th>
</tr>
</thead>
<tbody>
<tr>
<td>average values</td>
<td>11.94</td>
<td>9.53</td>
<td>21.47</td>
<td>19.06</td>
<td>2.41</td>
</tr>
<tr>
<td>from 1 to 9 empl.</td>
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<td>13.29</td>
<td>30.13</td>
<td>26.58</td>
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</tr>
<tr>
<td>from 10 to 19</td>
<td>10.53</td>
<td>8.12</td>
<td>18.65</td>
<td>16.24</td>
<td>2.41</td>
</tr>
<tr>
<td>from 20 to 49</td>
<td>8.97</td>
<td>7.13</td>
<td>16.09</td>
<td>14.25</td>
<td>1.84</td>
</tr>
<tr>
<td>from 50 to 199</td>
<td>7.23</td>
<td>6.18</td>
<td>13.41</td>
<td>12.36</td>
<td>1.05</td>
</tr>
<tr>
<td>from 200 to 499</td>
<td>9.67</td>
<td>6.54</td>
<td>16.21</td>
<td>13.07</td>
<td>3.13</td>
</tr>
<tr>
<td>500+</td>
<td>5.24</td>
<td>6.02</td>
<td>11.26</td>
<td>10.49</td>
<td>-0.77</td>
</tr>
</tbody>
</table>

Table 2: Job flows by size classes using current and long average estimations: comparative results.
of job creations and job destructions by macrosectors and size classes using the long average method\textsuperscript{14}. Macrosectors show a common pattern regard to the relative high number of creations and destructions due to firms of first size class (1-9 employees) compared to the others. Manufacturing small firms give smaller contribution to total job creations and destructions; moreover, the percentage flows are above 10\% in the size classes 10-19, 20-49 50-199 and 200-499. Apart from the first class we observe increasing percentages contributions with a peak for 50-199 class both for creations and destructions. Small firms from 1 to 9 employees belonging to services and construction macrosectors are responsible for 70\% of flows, other classes present residual percentages of job flows with bigger firms accounting for smaller percentages.

Looking at table 3, we find that manufacturing presents higher rates of creation and destruction for smaller firms. The same pattern holds for excess job reallocation. The net employment growth is negative for bigger firms (belonging to classes: 200-499 and 500+) and the engine of growth is represented by firms from 10 to 19 employees.

Construction macrosector pattern confirms the importance of small firms in generating and destroying jobs, but the last class, that groups large firms with more than 500 employees, presents high reallocation rate and excess reallocation. The magnitude of reallocation is principally explained by job destruction (around 9\%) as confirmed by the negative rate of net employment growth. The rationale of the evidence

\textsuperscript{14}Results obtained using current average size methodology are similar.
Table 3: A comparison of average annual based job creation and destruction flows by size classes and by macrosectors using current vs long average measure of firms’ size.

is related to the contraction of a small number of big construction firms along the period considered.

Services job flows by size classes are more equally distributed and the net growth of the macrosector along the period under analysis is the result of balanced contributions of firms belonging to different classes. In particular, big firms with 200-499 employees play a major role. This different evidence is the result of the composition of two combined effects: an expansion per se of macrosector and a different structure of services firms, in terms of capital intensity of technologies employed.

3.4 The sectoral distribution of flows

Macrosectors presents differential dynamics on terms of job flows. Table 4 present average annual job flows for three macrosectors. Manufacturing presents a lower level of job creation and destruction than services and construction. The higher job reallocation rate presented by services is explained by a high job creation rate -with a correspondent lower than other macrosectors job destruction rate. As a consequence, most of the net creation of jobs is accounted by services.
Table 4: Average job flows over the period 1991-2001 for macrosectors.

Looking at excess job reallocation we can see that services "uses" lower gross reallocation to create jobs compared to other macrosectors. This empirical evidence is in line with stylized facts, cf. Davis and Haltiwanger (1999).

3.5 The role of firms’ age in determining flows

An important question about the flows dynamics is related with the role of firms’ age in job creation and destruction activity. In particular, the role of entrant firms in job creation process it is important given the implications it has on the local industrial and labor market policies.

We identify entrant firms as those firms which operate in the market from less than 12 months, coherently to definition used in literature, cf. Davis et al. (1996). Table 5 presents creation and destruction rates for macrosectors disaggregated by age classes. Each flow is decomposed in order to single out the contribution of each age class. In the second section of table we calculated the percentage contribution to flows by age classes.

We begin our analysis considering the role of entrant firms in the job creation process given the important role they play under the point of view of industry dynamics. The share of job creation accounted by entrant firms appears to be lower than average values of Italy, cf. table 1. At international level there can be found both lower and higher contributions of entrant firms, such evidence can be explained by different institutional setups and different degree of opportunity in the market.

Figure 8 shows the contribution year by year of entrant firms to the process of job creation. The annual creation flow accounted by entrant firms varies from 10% to around 26% and it is directly correlated with the phases of economic cycle.

At sectoral level, Manufacturing entrant firms account for 16.7% of average job creation of the macrosector. Job creation and destruction rates for entrant firms of services and construction are above 20% and
they are higher than average contributions showed by manufacturing. This sectoral ranking respect to creation activity represents a stylized fact -cf. Davis and Haltiwanger (1999).

Contribution to job creation of other age classes reveals a non-linear linkage between the intensity of flows and the age of firms. Firms that are from 2 to 5 years old and those that are more than 10 years old account for around 30% each of overall creation. Job destruction patterns within age classes for manufacturing seem to reveal negative correlation between age and destructions. We can note that the majority of destructions has to be accounted by older firms.

### 3.6 Job creation, job destruction and exit process

In this paragraph we focus on exit dynamics of firms and on the effects related with job flows they induce in the system.

Figure 9 presents the average annual percentage of job destructions accounted for by exiting firms. From the figure we can observe that business cycle shapes the destruction flows accounted for by exits. On average two thirds of destructions are due to exits. Job flows comparison presented in table 1 shows that exiting firms contribution to destructions of Trentino firms is of similar magnitude compared to Italy.
<table>
<thead>
<tr>
<th></th>
<th>rates subdivision:</th>
<th>percentage contributions to sectoral flows:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>jc</td>
<td>jd</td>
</tr>
<tr>
<td><strong>manufacturing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from 0 to 1 year old</td>
<td>1.66</td>
<td>0.01</td>
</tr>
<tr>
<td>from 2 to 5 years</td>
<td>3.18</td>
<td>1.23</td>
</tr>
<tr>
<td>from 6 to 10 years</td>
<td>1.38</td>
<td>1.63</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>3.68</td>
<td>6.22</td>
</tr>
<tr>
<td><strong>construction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from 0 to 1 year old</td>
<td>2.80</td>
<td>0.07</td>
</tr>
<tr>
<td>from 2 to 5 years</td>
<td>4.55</td>
<td>2.56</td>
</tr>
<tr>
<td>from 6 to 10 years</td>
<td>1.92</td>
<td>2.11</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>3.99</td>
<td>7.49</td>
</tr>
<tr>
<td><strong>services</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from 0 to 1 year old</td>
<td>2.88</td>
<td>0.04</td>
</tr>
<tr>
<td>from 2 to 5 years</td>
<td>3.97</td>
<td>2.24</td>
</tr>
<tr>
<td>from 6 to 10 years</td>
<td>1.65</td>
<td>1.81</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>4.68</td>
<td>4.90</td>
</tr>
</tbody>
</table>

Table 5: Job flows by macrosectors and age classes of firms

Figure 9: Yearly percentage job destruction contribution of exit firms.  
Source: Our elaborations on database DM10TN.
3.7 Regression analysis results:

Separate regressions we run are based on the following linear functional forms:

\[ j_{ci} = \alpha + \beta_1 \log(\text{Size}) + \beta_2 \log(\text{Age}) + \beta_3 \text{age}^2 + \beta_4 \text{Size} \times \text{Age} + \]
\[ + \beta_5 D_{\text{const}} + \beta_6 D_{\text{serv}} + \beta_7 \text{Dune} + \epsilon_{jc} \] (14)

\[ jd_i = \alpha + \beta_1 \log(\text{Size}) + \beta_2 \log(\text{Age}) + \beta_3 \text{age}^2 + \beta_4 \text{Size} \times \text{Age} + \]
\[ + \beta_5 D_{\text{cons}} + \beta_6 D_{\text{serv}} + \beta_7 \text{Dune} + \epsilon_{jd} \] (15)

in which: (a) \( \log(\text{Size}) \) is the log of average annual size of firm; (b) \( \log(\text{age}) \) is the log of firm’s age expressed in month of activity, (c) \( \text{age}^2 \) is a squared transformation of age used to clean-out for non-linear effects of age, (d) \( \text{Size} \times \text{Age} \) is the interaction term between size and age of firm, (e) \( D_{\text{cons}} \) and \( D_{\text{serv}} \) are, respectively, dummy variables for construction and services sector, (f) \( \text{Dune} \) is the rate of changes in unemployment rate.

In table 6 we report estimation results, respectively, for job creation and job destruction rates based on separate regressions and on the two steps method HMM (augmented regressions)\(^ {15} \).

A preliminary observation is that the selectivity term we included is strongly significant both for job creation and job destruction equation. This indicates the existence of a selection bias for the firms that distorts the standard OLS estimations and confirms the need of a correction of results.

The F test allows us to reject the null hypothesis of joint zero value for the whole set of parameters in both for separate regressions and HMM regressions. The \( R^2 \) values reveals that we account for around 15% of variance of the sample for job creation equation and around 20% in the case of job destruction using separate regressions. Once we apply HMM, we observe an increase in \( R^2 \) in both equations for job creation and destruction. All the explicative variables used are significant. In particular, size and age are negatively correlated with creation and destruction rates.

The logarithm of size is negatively correlated with job creation and destruction rates and considering the correction its effect is stronger: the effect is milder for job destruction (the estimated parameter value changes from -23.89 to -36.69) and seems to be consistent for job creation (from -15.57 to -97.86).

\(^ {15}\)We do not report other versions of regression in which we used different variables to capture business cycle phases. In particular, we tested the significance of the level of unemployment rate, but results were not satisfactory.
A similar pattern emerges for the role of firms’ age. From descriptive results it was not possible to disentangle its role on job flows. Once we clean out for spurious effects, age of firms appears to be negatively correlated with creation and destruction rates enforcing the role of young firms in generating jobs dynamics.

The interaction term \((Age \times Size)\) reveals the existence of a combined effect of age and size but the magnitude seems to be low. Similarly the non linear effect of age \((\text{age}^2)\) is significant too, but its effect is small. The HMM estimation does not change sensibly the estimation and the significance of these two variables.

Sectoral dummy for construction macrosector reveals that, other things being equal, this macrosector presents higher job creation and destruction rates. The HMM estimation does not provide additional insights. Dummy for services reveals, looking at separate regressions results, a negative correlation with job flows that seems to be not in line with previous descriptive results. The use of HMM estimation in this case corrects estimations such that we are able to reconcile with evidence. The estimated coefficient for job creation regression using HMM becomes positive indicating that services show higher job creation rate compared to manufacturing\(^{16}\). Coefficient for job destruction is instead negative and its sign remains negative using HMM. This evidence seems to be coherent with the positive trend experimented by services in the time window we study: job destruction for services fluctuates less than other macrosectors and this determines the growth of sector in terms of number of employees.

Changes in rate of unemployment appear to be negatively related with job creation rate and positively related with job destruction rate. Using HMM the effects on job flows are amplified. The result confirm the role played by macroeconomic conditions in generating job flows. Moreover, given that we rejected as regressor the level of unemployment in favor of changes in unemployment rate, we underline that firms activities of job creations and destructions are not sensible to stock of unemployment accumulated in the system, but is highly responsive to changes form one period to another.

### 4 Conclusions

The study analyses job flows in Trentino from 1991 to 2001. The high quality of data allows us to study complementary aspects to shed light on dynamics of Trentino labor market. Empirical findings can

\(^{16}\)Note that we excluded manufacturing sectoral dummy, so that the basic formulation of regression is referred to manufacturing itself.
be summarized in a series of key points: (a) job flows shows a “fractal” nature, i.e. many regularities appear to be scale invariant (magnitude of flows and their persistence). In particular job flows magnitude is in line with average values of Italy; (b) There exist some qualifications to “fractality”: entrant firms contribution to job creation process is lower than the corresponding contribution at national level. Whereas, job destruction share accounted for by exit firms is around 30% in line with stylized facts; (c) size and age shape the job flows; (d) between macro sectors shifts of jobs are rare.

The resulting picture of Trentino labor market presents some interesting points. The magnitude of flows that appears to be in line with Italian level can be interpreted as the direct effect of national institutions governing labor market that constraint local performances. Sectoral differences in job flows confirm the common wisdom about sectors different behaviors: services and construction sectors appear to be more dynamic even if changes in individual employment levels are more probable; manufacturing sector is more sticky, compared with services, given the charateristics of the sector, e.g. the nature of production process, the degree of capital intensity, etc..

Size and age of firms are the two major structural determinants of job flows. A strong negative correlation emerges between job flows and these variables. In particular, small and young firms are responsible for the bigger percentage of creations and destructions\(^{17}\).

However, our results suggests that geographical disaggregation matters in job creation and destruction flows. Indeed, the above evidence, coupled with the low contribution to job flows of entrant firms represents a critical aspect of Trentino. In particular, it seems that small young firms create jobs but are unable to grow.

Sectoral differences, recalled above, coupled with the evidence of extremely low shifts of jobs between sectors, seem to reflect the inability at local level to seek more efficient production factors utilization.

This evidence supports interpretations of industry dynamics based on heterogeneity of firms both observable and unobservable. In this respect, we find evidence that structural variables are able to account for 1/5 of variance of job creation and destruction flows. Moreover, we show that heterogeneity of flows even within firms with similar characteristics persists.

\(^{17}\)Elaborations show that the variables age and size of firms are positively correlated between themselves, results are not shown.
<table>
<thead>
<tr>
<th></th>
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<th>job destruction</th>
<th>HMM</th>
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<td>-0.0029</td>
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<tr>
<td></td>
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</tr>
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</table>

Legend: Dune: changes of unemployment rate; Dcons: dummy variable for construction; Dserv: dummy variable for services.

Table 6: Structural determinants of job creation and destruction flows: a regression analysis.
References


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Genda, Y. (1998), Job gains and losses in Japan: a comparison with Italy, Special Topic 37-1, Faculty of Economics, Gakushuing University.


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A  Appendix: level of analysis

The measures of job flows we built are coherent with the definitions of Davis et al. (1996). The availability of monthly data leads us to estimations of job flows rates referring a yearly based measure.

Monthly estimations have the characteristic of capturing also cyclical movements of firms and hence represent a "real" measure of micro turbulence of labor market in Trentino. The choice of working with monthly data is based on the need of reasoning on the finest detail available and on the aim of exploiting database as much as possible. Knowing that shortening the period of observation can leads to distortions in job flows estimations due to overestimation of transitory phenomena and to misspelled workers movements, we decided to conduct our analysis on the basis of annual estimations, even if we provide some table with monthly estimations. Estimation of annual flows consists of two steps: (a) the estimation of yearly average number of employees per firm; (b) the estimation of annual job flows -using the Davis et al. (1996) methodology. Annual estimation offers the advantage of comparability with other studies. Note that we employ monthly information in the construction of the average number of employees per year, this, in turn, reduces distortions about job flows estimations.
We are aware that results on job flows obtained through the methodology proposed by Davis et al. (1996) has to be interpreted with care. In fact, the measurement of "real" job creations and job destructions implies, from a theoretical point of view, the possibility of measuring the actual number of jobs -i.e. productive locations- entailed by each firms, but there are not database based on this direct observation.

It is worthwhile to note that comparability of studies is difficult in any case as noted by many researchers (Davis and Haltiwanger (1999), Faggio and Konings (2003), Acs et al. (1999) and Blanchflower (1994)).

Nevertheless, we prefer annual based estimations to "position" our study in the international evidence and to make comparisons and interpret correctly the results. Where possible we provide also monthly based estimations trying to interpret dissimilarities between the different methods.