Do Small Businesses Create More Jobs? New Evidence for Europe

Please note that the final version of this paper is forthcoming in Small Business Economics (DOI 10.1007/s11187-013-9480-1).

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Zoetermeer, March 2013

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This research has been partly financed by SCALES, SCientific Analysis of Entrepreneurship and SMEs (www.entrepreneurship-sme.eu)

Research Reports

reference number	H201203
publication	2013
number of pages	23
email address corresponding author	j.de.kok@panteia.nl
address	Panteia Bredewater 26 P.O. box 7001 2701 AA Zoetermeer The Netherlands Phone: +31(0)79 322 22 00

All the research reports are available on the website www.entrepreneurship-sme.eu.

Do Small Businesses Create More Jobs? New Evidence for Europe

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Abstract:

In this paper we argue why, in our view, the so-called dynamic classification method should be favored when determining the contribution of small businesses towards job creation. First, it is the only method that consistently attributes job creation or loss to the size class in which it actually occurs. In addition, dynamic classification has two other advantages: (i) it is not vulnerable to the so-called regression to the mean bias and (ii) only a small number of aggregated data are required for its application.

Using the dynamic classification we analyze job creation within the different size classes for the 27 Member States of the European Union. Our main findings are as follows:

- For the EU as a whole, smaller firms contribute on a larger scale towards job creation than larger firms do. Net job creation rates decrease with each firm size class.
- This pattern occurs in most industries however, not in all: the manufacturing industry and trade industry show different patterns.
- At the level of individual countries, the net job creation rate also tends to decrease with each firm size class. However, this relation is not perfect.

Keywords: Employment growth by size class, Employment creation, Firm employment decisions.

JEL classification codes: E24, M51, L25

First version: February 2012, titled "Determining the contribution of size classes to employment growth"

Second version: September 2012, titled "Determining the contribution of size classes to employment growth"

This version: March 2013, titled "Do Small Businesses Create More Jobs? New Evidence for Europe", forthcoming in *Small Business Economics* (DOI: 10.1007/s11187-013-9480-1)

Acknowledgements. We are appreciative to two anonymous experts for their constructive suggestions towards the improvement of this paper. The paper has been written in the framework of the research program SCALES carried out by Panteia/EIM and financed by the Dutch Ministry of Economic Affairs.

1. Introduction

Since the seminal studies conducted by Birch (1979, 1981, 1987) it has been a recurring question in the discipline of Small Business Economics as to what extent small businesses contribute towards job creation. This paper contributes to this topic in two ways. First, we provide new arguments as to why the rarely used method of dynamic classification should be preferred for determining the contribution of small businesses towards net employment creation. Second, we provide new evidence on the subject for the 27 Member States of the European Union.

How does this paper fit in relation to the relevant literature?[1] The central message of Birch's work back in the eighties of the previous century was that small businesses are the most important source of net job creation in the United States of America and as such, his work was quite influential in policy circles (Neumark et al., 2011, p. 16).

Subsequently, in the nineties of the previous century, a debate started on methodological issues. Markedly, Davis et al. (1996) stated that researchers should address at least three statistical pitfalls, viz. (i) the size distribution fallacy, (ii) the confusion between net and gross job creation and (iii) the regression to the mean bias. They concluded that – when all these statistical pitfalls were correctly addressed – smaller businesses do *not* exhibit higher net job creation rates. More specifically, they concluded that Birch's results were not valid due to the regression to the mean bias.

However, the Davis et al. article was not unchallenged. In that same year Carree and Klomp (1996) stated that in all academic studies the first two pitfalls were already addressed correctly, while the influence of the regression to the mean bias was overstated by Davis et al.. Two years later, Davidsson et al. (1998) came to the same conclusion. They stated that one could argue that the regression to the mean bias was not a problem. However, even if one should accept it as such, this possible bias would only be slight. On the basis of Swedish data they found that small businesses show a higher net job creation, even when correcting for the regression to the mean bias. Various other authors, e.g., Broersma and Gautier (1997), Picot and Dupuy (1998), and Voulgaris et al. (2005) came to the same conclusion. However, Hohti (2000) did not find that small establishments create more jobs.

More recently, Okolie (2004) and Butani et al. (2006) compared different rivaling methods to determine the contribution of small businesses to net job creation. Okolie (2004) concluded that results are quite different depending on the method adopted. Butani et al. (2006) went a step further. First, they reintroduced the so-called method of dynamic classification in the literature. This was a method originally proposed by Davidsson (1996). Second, they went on to compare the merits of this method with a number of rivaling methods. After an

[1] See Neumark et al. (2011) for a more comprehensive overview of the relevant literature. The current section is partially based on their overview.

extensive analysis they concluded that the method of dynamic classification was the preferred method.

Recently, Neumark et al. (2011) investigated whether small businesses create more jobs for the United States of America. They found confirmation of Birch's results in the eighties of the previous century that indeed small businesses create more jobs. However, despite the analysis of Butani et al. (2006) they did not use the method of dynamic classification in their analysis.

We are now able to point out the added value of this paper with respect to the literature. First, the fact that Neumark et al. (2011) did not use the method of dynamic classification shows that this method still is not generally accepted. In this paper we give further elaboration for some of the arguments put forward by Butani et al. (2006) in favor of this method. Second, we show that dynamic classification has a practical advantage that has so far been overlooked in the literature. Contrary to other methods, dynamic classification only requires a small number of aggregated data for its application. Third and lastly, the recent analysis of Neumark et al. (2011) is restricted to the USA, while in this paper we provide new evidence on the job creation of small businesses for all 27 Member States of the European Union.

The structure of this paper is as follows. Section 2 covers the methodology; the size distribution fallacy is explained, together with four rivaling methods from the literature on how to address and find a solution for it. We argue that one of these methods – dynamic classification – is preferred for theoretical and practical reasons. Section 3 takes a closer look at a practical advantage of the method of dynamic classification that has so far been overlooked in the literature. Section 4 describes the data that we used to determine the job creation of different size classes for the 27 Member States of the European Union. Section 5 presents the results and compares these to the recent results for the United States by Neumark et al. (2011) and finally, Section 6 presents our conclusions.

2. Methodology

2.1 Solving the size distribution fallacy: four methods

The net job creation or loss of a certain firm size class between two consecutive years is *not* simply equal to the difference in the level of employment in this size class between these two years.[2] This is the so-called size distribution fallacy. It is caused by the fact that firms may cross size-class boundaries between years. The term was introduced by Davis et al. (1996, pp. 301-303). More specifically, the cause of for example, an increase in the employment level may not

[2] In this paper we follow existing research by dividing firms into different size classes to investigate the relationship between net job creation and firm size. However, the act of dividing firms into different size classes might introduce potential biases. Neumark et al. (2011, pp. 26-27) addressed this point by alternatively investigating the relationship between net job creation and firm size without the introduction of size classes. This robustness test does not alter their results. Although we are not able to do such a robustness test ourselves in this paper due to the lack of data, we are therefore confident that such potential biases are small.

only be due to job creation of firms in the size class, but may also be due to firms that have entered the size class (by growing or declining). Clearly, we do not want to label the employment increase due to the latter cause as job creation by the specific size class. Therefore, we should use a correction for it. Carree and Klomp (1996, p. 317) observed that indeed all academic studies corrected for the size distribution fallacy.

To correct for the size distribution fallacy we need longitudinal data at firm level that underlie the macro data on the employment level of size classes[3]. More specifically, if we have information on the employment size of all firms over two consecutive years, we can split the firms up into two groups:

1. Firms that remain in the same size class in these two years. The job creation or loss due to these firms can be attributed straightforwardly to the size class to which they belong.
2. Firms that cross a size class boundary between these years. The question then is to which size class we should attribute the job creation or loss due to these firms.

However, the answer to this question is not straightforward. In fact, in the literature we encounter at least four rivaling methods with respect towards how to classify the job creation or loss of these firms.[4]

First, you could attribute the job creation or loss of these firms to the size class to which they belong in the base year. This classification according to *base-year size* seems the most obvious and indeed the three seminal studies of Birch (1979, 1981, 1987) adopted this classification method.[5]

However, Davis et al. (1996) argued that this classification method might be vulnerable to a regression to the mean bias (to be discussed below). To correct for this bias they suggested classifying firms into size classes on the basis of their average size over the two years. We refer to this classification method in this paper as classification by *average size*.[6]

For the purpose of symmetry reasons, Okolie (2004) discussed yet another method in which the job creation or loss of firms is attributed to the size class to which they belong in the end year. She appropriately calls this method classification by *end-year size*.

The final classification method – the so-called *dynamic* classification[7] – has received relatively little attention in the literature up until now. It was introduced by Davidsson (1996) and discussed by Butani et al. (2006). The classification is dynamic in the sense that the job creation or loss of a firm is not attributed to a single size class, as is the case in the other three methods. Instead, the job crea-

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[3] See, however, section 3 where it is shown that dynamic classification can also be applied without longitudinal data at firm level.

[4] Davis et al. (1996) additionally introduced yet another method in which firms are classified on the basis of their long run average size. They call this method classification by *average size*. For reasons given by Carree and Klomp (1996, pp. 318-319), we do not discuss this method here.

[5] If you have quarterly data you have a further choice between classification by *annual base size* and *quarterly base size*. See Butani et al. (2006).

[6] We follow Neumark et al. (2011) in this. Davis et al. (1996) refers to it as classification by *current size*¸ and Okolie (2004) and Butani et al. (2006) refer to it as classification by *mean size*.

[7] Butani et al. (2006, p. 6) remarked that the method is also referred to as classification by *momentary size*.

tion or loss of a firm is attributed to the size class to which the firm belongs *at the moment job creation or loss actually occurs*.

We illustrate the idea behind dynamic classification with a simple example. Consider a firm that grows from 200 to 290 employees during the year, while the size class boundary is at 250 employees. While growing from 200 to 250 the firm belongs to the lower size class. Therefore, the creation of these first 50 jobs is attributed to the lower size class. Once the firm has reached the size class boundary of 250 employees, the firm enters the upper size class. When growing further from 250 to 290 employees the creation of these further 40 jobs is attributed to the upper size class.

2.2 Choice of method does matter …

The prevalence of four rivaling classification methods would not matter that much if all methods were in practice to produce approximately the same results. Unfortunately, the opposite is the case as shown in Table 1, where we give the example for the situation in the Netherlands from 1993 – 1998 (from De Kok et al. 2006, p. 29).

We are able to make two further observations that more or less carry on from the way the various classification methods are defined:

- Classification by base-year size gives results that are most favorable to small firms, classification by end-year size gives results that are most favorable to large firms, while the other two methods give results that are somewhere in between.
- Classification by average size generates results that are similar to the results generated by dynamic classification. Note, however, that the theoretical basis of the two methods and therefore, the ways of calculation, is quite different.

All findings are typical and in line with the results of others. See, e.g., Okolie (2004), Butani et al (2006), and Neumark et al. (2011).

2.3 Which method to prefer?

As observed in the introduction, since the analysis conducted by Davis et al. (1996) there has been a debate on the best way to attribute job creation or loss to size classes. Despite the comprehensive analysis of Butani et al. (2006) leading to a preference of dynamic classification, there still seems to be no clear consensus on the subject in the literature. This is illustrated by the recent analysis of Neumark et al. (2011) in which dynamic classification is not considered.

Due to the fact that we agree with Butani et al. (2006) that dynamic classification is preferable, we set out here to further elaborate some of their arguments. Butani et al. (2006) introduced five criteria for the evaluation of classification methods: (i) whether the method is potentially vulnerable to the regression to the mean bias, (ii) how firm births are treated, (iii) whether the method is consistent with other classification methods of the Bureau of Labor Statistics of the

USA, (iv) whether the method exhibits additivity across quarters[8] and (v) whether the method is comprehensible to users. As we are of the opinion that their criteria (ii), (iii) and (iv) are of minor importance, we will not elaborate further on them here, but instead we will focus on three main issues in this section.

Table 1 Average annual net job creation of the Dutch private sector, by size class and classification method, 1993-1998

	Size classes (number of employees)							
	Small (0-10)		*Medium sized* (10-100)		*Large* (100+)		*Total*	
Method	*abs*	*rel*	*abs*	*rel*	*abs*	*Rel*	*abs*	*rel*
Uncorrected	6	1,1%	16	1,4%	19	1,0%	41	1,2%
Corrected according to:								
- classification by base-year size	42	7,6%	8	0,7%	-9	-0,6%	41	1,2%
- classification by average size	15	2,7%	14	1,1%	12	0,7%	41	1,2%
- classification by end-year size	-13	-2,4%	25	2,1%	29	1,6%	41	1,2%
- dynamic classification	13	2,4%	14	1,2%	13	0,7%	41	1,2%

abs: absolute employment change in full-time equivalents (x 1.000);
rel: absolute employment change, as percentage of average employment level for each size class;
First the job creation is calculated from year to year. After that the results are averaged.
Source: own calculations on data of Statistics Netherlands. See for more information on the data De Kok et al. (2006).

First, one possible decision criterion in deciding which method is preferred could be whether a method consistently attributes job creation or loss to the size class in which it actually occurs. Butani et al. (2006, p. 14) discussed this issue in the context of their evaluation criterion (v) "comprehensibility to users". However, we believe that they did not give the argument as much credit as it deserves. While they present the argument as an "admittedly subjective evaluation criterion", we believe that it should be the most compelling reason for preferring dynamic classification. For that reason, we will elaborate on that argument in this section and use examples to illustrate it.

Second, Butani et al. (2006, p. 6 and p. 14) and Neumark et al. (2011, p. 18) seemed under the impression that dynamic classification hinges on the assumption that firm growth takes place linearly through time. If this were the case it would weigh heavily upon the method, as in reality, firm growth obviously does not need to be linear. However, this assumption is *not* required. In this section we will show that dynamic classification works just as well with any other pattern of firm growth.

[8] More specifically, do the quarterly net employment growth statistics by size class add up across quarters to the same net employment growth statistics by size class that would be computed from a longer measurement frequency such as an annual change?

Third, the regression to the mean issue has dominated this debate from the start. We agree with Butani et al. (2006, p. 12) that this issue is of the utmost importance when evaluating classification methods. Therefore, in this section we will summarize the state of the art knowledge on this issue, but have nothing further to add ourselves on the subject.

Attributing job creation to where it actually occurs

To which size class should the job creation or loss of firms be attributed? A compelling and reasonable starting point in answering this question is in our opinion the following simple principle: "job creation or loss should be attributed to the size class to which a firm belongs at the moment that this job creation or loss actually occurs". Does this principle lead to a recommendation of one of the methods? Yes, it does. The following example explains this.

Take the size class boundary at 250 employees and consider a firm that grows in one year from 200 to 290 employees (e.g. in the first quarter of the year from 200 to 250 employees and in the remaining three quarters of the year from 250 to 290 employees). Classification by base-year size attributes the creation of the 90 jobs of this firm solely to the lower size class. Classification by average size does the same (for the average size of the firm is 245), while classification by end-year size attributes the entire growth of 90 additional jobs to the upper size class. Therefore, none of these three methods attributes all 90 created jobs to the size class in which they really were created! In fact, the only method that does justice to this principle is dynamic classification: 50 of the jobs were created in the lower size class (in the example in the first quarter of the year) and are indeed attributed to it with dynamic classification, while the same holds for the remaining 40 jobs that were created in the upper size class.

Note that from this point of view classification by base-year size leads to a bias in favor of small businesses. The reason for this is that job creation by small firms that cross a size class boundary is solely attributed to the size class of small firms, while at least part of it should have been attributed to the upper size class. In addition, job losses by large firms that cross a size class boundary are solely attributed to the size class of large firms, while at least part of these job losses should have been attributed to lower size classes.

By way of the same reasoning it is clear that classification by end-year size leads to a bias in favor of large businesses. Moreover, classification by average size does not lead to a systematic bias in one direction. The method can favor the size class of small firms as well as the size class of large firms, depending on the specific details. (In our example the size class of the lower size class was favored but with slightly different size values the reverse would have been the case.)

In our example, and also in the empirical section of this paper, the interval between successive measurements is 1 year. Note that the discussed bias will be larger when this period is larger and vice versa.

No assumption of linear firm growth needed

Butani et al. (2006, p. 6 and p. 14) and Neumark et al. (2011, p. 18) seemed under the impression that dynamic classification hinges on the assumption that firm growth takes place linearly through time. The next example shows that this is not the case and that dynamic classification works just as well with any other pattern of firm growth.

Consider again the example with the size class boundary at 250 employees and a firm growing in one year from 200 to 290. Now assume a completely different growth path than in the previous example. Let us assume that in the first quarter the firm declines from 200 to 170, subsequently grows from 170 to 300 in the second quarter, declines to 240 in the third quarter and eventually grows in the fourth quarter to the final 290. Indeed, not a linear growth pattern at all! According to the principle of attributing job creation or loss to the size class in which it occurs we get the following:

- first quarter: lower size class: -30;
- second quarter: lower size class: +80; upper size class: +50;
- third quarter: lower size class: -10; upper size class: -50;
- fourth quarter: lower size class: +10; upper size class: +40.

If we sum up the four quarters together, we indeed find a net job gain of +50 for the lower size class and +40 for the upper size class which is what we got for the first growth pattern. We conclude that dynamic classification is independent of the growth patterns of the individual firms.

Regression to the mean bias

Davis et al. (1996) pointed out that some classification methods might be vulnerable to a so-called regression to the mean bias. Let us first clarify the potential problem by giving an example.

Take the size class boundary at 250 employees and consider 100 firms of which the sizes fluctuate around this boundary each year. Let's say 50 grow each year from 245 employees to 255 employees, while the other 50 decline from 255 employees to 245 employees.

Classification by base-year size leads to the assessment that the lower size class creates 500 jobs each year, while in the upper size class 500 jobs are lost. Generally, in this classification method such fluctuations typically are in favor of the lower size class and in disfavor of the upper size class. Assessments are exactly the reverse when adopting classification by end-year size. Moreover, note that the other two methods - classification by average size and dynamic classification – are immune to such fluctuations and lead to the conclusion that there is no net job creation or loss in both size classes.

In reality, part of such size fluctuations of firms around a size class boundary will be due to transitory shocks or measurement errors in the data set. If this is the source of the fluctuations, one does not want these fluctuations to have an influence on the outcome of the classification procedure. If this does occur, then it constitutes a bias, the so-called regression to the mean bias. As shown in the example, results are biased in favor of the lower size classes when classifying according to base-year size, while the reverse is the case when classifying according to end-year size. There is no potential bias in the other two classification methods.

Davis et al. (1996) stated that most – if not all – size changes of firms are due to transitory shocks and measurement errors. This leads them to conclude that the bias may potentially be quite high. However, later authors, e.g. Carree and Klomp (1996) and Davidsson et al. (1998) disagreed and argued that this bias could be quite moderate. Up until now – see Neumark et al. (2011, p. 18) – there is no clear consensus as to what extent the potential regression to the mean bias actually constitutes a substantial problem. However, there *is* a clear consensus in the literature regarding the fact that classification by average size and dynamic classification are not vulnerable to this potential bias. In fact, this was the major reason for Davis et al. (1996) to introduce classification by average size. With respect to dynamic classification Butani et al. (2006, p. 12) also observed that the method is not vulnerable to the potential regression to the mean bias.

Conclusion

All in all, we believe that the method of dynamic classification should be the preferred method. First, it is the only method that consistently attributes job creation or loss to the size class in which it actually occurs, a principle both compelling and reasonable in our opinion. Although we are not the first to observe this (see Butani et al., p. 14), the argument deserves more emphasis than it received in their paper.

In addition, we point out in this paper that dynamic classification does not hinge on the assumption of underlying linear growth paths, while Butani et al. (2006) and Neumark et al. (2011) seemed under the impression that it does.

A second point in favor of dynamic classification is the fact that the method is not vulnerable to a potential regression to the mean bias (Butani et al., 2006, p. 12). Although the method shares this desirable property with classification by average size (Davis et al., 1996), it constitutes a distinct advantage of the method compared to classification by base-year or end-year size.

In addition to these theoretical reasons there is also a practical reason for choosing the dynamic classification method: only a small number of aggregated data are needed to for its application. This is an advantage that so far has been overlooked in the literature. [9] The following section will address this issue.

3. Dynamic classification: only a small number of aggregated data needed

The method of dynamic classification has a practical advantage that has so far been overlooked in the literature. Contrary to all other methods discussed in

[9] We already noted this in our unpublished working paper De Kok et al. (2006).

this paper, dynamic classification does not require longitudinal data on the employment level of individual firms. We will first illustrate this using a simple example.

3.1 Simple example

Consider only two size classes – a lower and an upper size class – with the boundary at 250 employees. During the year employment in the lower size class has gone up with – say – 20 thousand jobs and employment in the upper size class with 40 thousand jobs. However, we also know that during this year 100 firms grew significantly and crossed the size class boundary. This gives rise to a size distribution fallacy (see Section 2). How should we correct for this size distribution fallacy?

Employment in the upper size class has increased with 40 thousand jobs. However, part of this employment gain is due to the fact that 100 firms entered the upper size class. Therefore, we should subtract from these 40 thousand jobs gained, the employment that these 100 firms had when they entered the upper size class. By definition, all these firms had a size of 250 employees when they crossed the size class boundary. Therefore, we should subtract 100* 250 = 25 thousand jobs from the performance of the upper size class to correct for the fact that these 100 firms entered that size class.

For the lower size class we find something similar. Here, the performance of the size class should be corrected for the employment loss of the 100 firms that grew out of the size class, as all left the size class when they grew beyond 250 employees. Therefore, we should add 100*250 = 25 thousand jobs to the performance of the lower size class to correct for the fact that these 100 firms left that size class.

The upshot is that, when we adopt dynamic classification we only need to know how many firms crossed the size class boundary in order to correct for the size distribution fallacy. [10] This is in sharp contrast with the other classification methods in which longitudinal data are needed for the employment levels of all individual firms.

3.2 Dynamic classification: correction terms

By generalizing the argument given in the above mentioned example one can determine a general correction formula to correct for the size distribution fallacy in the method of dynamic classification (see the first row of Table 2 for a size class with lower boundary L and upper boundary U).

Note that the first term in this formula corrects for the number of net crossings of the lower boundary L, while the second terms corrects for the number of net crossings of the upper boundary U [11]. It can also be shown that in the general case of more than two size classes no longitudinal firm level data are needed for

[10] See the next section 3.2 for the exact data requirements for the general case.
[11] The number of net crossings of a boundary is equal to the change in the number of firms above this boundary.

dynamic classification [12]. More specifically, given the chosen size class boundaries, we only need to know the following aggregated data for each year:

- the employment levels of the specified size classes (to calculate the uncorrected employment changes of the size classes),
- and the number of firms that are present in the specified size classes (to correct for the size distribution fallacy according to dynamic classification).

Table 2 Dynamic classification: correction for the size distribution fallacy

Size class [a]	*Correction terms* [b]
Size class [L, U)	-L * (ΔN) L or larger + U * (ΔN) U or larger
Micro firms [0, 10)	10 * (ΔN) 10 or larger
Small firms [10, 50)	-10 * (ΔN) 10 or larger + 50 * (ΔN) 50 or larger
Medium sized firms [50, 250)	-50 * (ΔN) 50 or larger + 250 * (ΔN) 250 or larger
Large firms [250 or more)	-250 * (ΔN) 250 or larger

a "[L, U)" denotes a size class with lower boundary L and upper boundary U, where L is included and U is excluded.

b "(ΔN) L or larger" denotes the change (Δ) in the number of firms (N) of size L or larger.

In Table 2 and for the ease of the reader, we have explicitly written down the correction terms for the four size classes considered in the empirical part of this paper, viz. micro firms (0-10 employees), small firms (10-50 employees), medium sized firms (50-250 employees), and large firms (250+ employees). [13] Note that only the second correction term is present for micro firms (the lower boundary of this size class is zero) and that for large firms only the first term is present (this size class has no upper boundary).

4. Data

To the best of our knowledge, no dataset currently exists that contains longitudinal data on the complete enterprise population for all Member States of the EU. Previously, this implied that it was not possible to correct for the size distribution fallacy, and therefore, determine the contribution of small businesses to job creation. However, as we have shown in the previous section, the method of dynamic classification can still be applied, as long as aggregated data are available on the number of enterprises and the number of employees for differ-

[12] For more elaborations on the subject see De Kok et al. (2006, pp. 27-28, 47-50).

[13] We define size classes on a continuous scale in this paper, viz. [0,10), [10,50), [50,250), [250 or more). Other papers, e.g. Butani et al. (2006), defined size classes on a discrete scale, which would read as follows for our size classes: "1-9", "10-49", "50-249", "250+". We prefer the continuous definition for two reasons. (i) It is more general because in this way you can also handle data with employment measured in full-time equivalents (that need not be in integer values). (ii) When using classification by average size or dynamic classification, it is then clear from the mere definition of the size classes how you treat e.g. an average firm size of 9.5 (when classifying by average size) or how you divide the firm's employment increase between size-classes when a firm grows from e.g. 8 to 12 (when using dynamic classification).

ent size classes for each year. Such data exists at EU level: the Annual Report Database from the European Commission.

The Annual Report Database is part of the SME performance Review, one of the main tools employed by the European Commission to monitor and assess Member States' performance in implementing the Small Business Act[14]. It includes aggregated data on six variables: the number of enterprises, number of persons employed, value-added at factor costs, gross investment in tangible goods, turnover and wages and salaries. Since 2008, the Annual Report Database has been used to prepare the Annual Report on EU Small and Medium-sized Enterprises.

The Annual Report Database is constructed in several steps. First, national statistics are collected by the National Statistical Institute (NSI) of each country. Sources used by these NSI's are statistical surveys, business registers or administrative sources. Exactly how these three sources are used, differs between NSI's. Next, these national statistics are gathered and combined into an EU-wide dataset. Finally, any missing values are imputed[15]. Imputations relatively often occur at low industry aggregation levels and less often at the industry level that is used in this study.

The Annual Report Database contains aggregated data on all of the 27 Member States of the European Union. It covers four enterprise size classes[16] and eight industries. The industry classification is based on the NACE classification system[17]. This is the European standard for classification of enterprises by industry. At the highest level of aggregation, the NACE classification distinguishes 18 different sections (A – Q), eight of which define the non-financial business economy (C-I and K). The Annual Report Database is restricted to these eight sections. At a lower level of aggregation, these eight sections represent 42 different divisions. Most of the sections of the non-financial business economy include between 1 and 5 different divisions (the sections Construction and Hotels and restaurants even include only one division). The only exception is the manufacturing section that includes 23 different divisions (more than half of all divisions in the non-financial business economy).

The resulting data are publicly available from the website of the European Commission[18]. As of July 2012, the Annual Report Database covers the years 2002-2012 and consists of two separate files: the database for the Annual Report 2010/2011 (which covers the years 2005-2012) and the database for the Annual Report 2009 (which covers the years 2002-2008)[19]. As a starting point,

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[14] The Small Business Act was adopted in June 2008. It aims to improve the overall approach to entrepreneurship, permanently anchor the 'Think Small First' principle in policy making from regulation to public service, and to promote SMEs' growth.

[15] We have not found any documentation on the type, nature or number of imputations that have been made. We therefore cannot exclude the possibility that the imputations result in a bias in the outcomes of our analysis.

[16] The enterprise is defined as the smallest combination of legal units that is an organizational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise can contain one or several establishments. The enterprise size classes are based on a headcount of the number of occupied persons (the sum of the number of employees and the number of unpaid people employed).

[17] For this study, we use NACE rev 1.1.

[18] http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/index_en.htm#h2-2; accessed July 9th, 2012

[19] A third file is available on the website (database for the Annual Report 2008) but this does not include any additional data and was updated later (by the database for the Annual Report 2009).

we have used the most recent database for the Annual Report 2010/2011. The data for 2005-2007 are based on statistics obtained from the NSI's, while the data for 2008-2012 are estimates. We have excluded the estimated data from our study, with the exception of the estimates for 2008 that we used to decompose the employment creation between 2007 and 2008. To increase the time span of our study, we added data on 2002, 2003 and 2004 from the database for the Annual Report 2009. We checked for the presence of a trend-break between 2004 and 2005 by comparing the data on employment and enterprises from both databases for the year 2005. At EU-level, the difference between the two databases is always less than 0,5%, for all of the statistics on the number of enterprises or employees by size class. This suggests that a trend-break is not present. Our data therefore covers the years 2002-2008.

5. Results

Table 3 presents the net job creation levels and rates for four firm size classes, for the EU as a whole. It shows that smaller firms create more jobs than larger firms. This is justified in absolute, as well as in relative terms. Therefore, the early results of Birch (1979, 1981, 1987) still appear to be relevant.

Table 3 Average net job creation and employment in the non-financial business economy of the EU, by size class, based on dynamic classification (2002-2008)

	Size class (occupied persons)				
	0 to 10	*10 to 50*	*50 to 250*	*250 +*	*Total*
Average net job creation (x1000)	1,148	416	291	405	2,261
Average employment (x1000)	37,703	26,244	21,630	42,378	127,955
Average net job creation rate [a]	3.1%	1.6%	1.3%	1.0%	1.8%

a. Calculated as the average across years of the ratio of net job creation to total employment. Alternatively one could take row 1 divided by row 2. Then one gets approximately the same percentages, viz: 3.0% - 1,6% - 1,3% - 1.0% -1.8%.

Source: own calculations, based on the database for the Annual Report 2009 (for the years 2002-2004) and the database for the Annual Report 2010/2011 (for the years 2005-2008). Annual data on net job creation rates for the years 2002 – 2008 are also included in table 7 from De Kok et al. (2012)

This result is in accordance with the recent results of Neumark et al. (2011) for the United States[20]. The population that they examined differs from ours regarding the industries and years covered. In addition, they distinguish between more (and different) size classes[21]. Nevertheless, the main results are strikingly similar. First, both the non-financial business economy of the EU (2002 – 2008) and the business economy of the USA (1992 – 2004) show an average net job

[20] Neumark et al. (2011) presented results for two different methods: classification by base year size and by average size. We take their results from the latter method as a reference, because classification by average size gives results comparable with results from dynamic classification, the method employed in this paper (see Section 2 of this paper).

[21] Neumark et al. included the financial industry, covered a longer period of time, and distinguished 12 different size classes.

creation rate of 1,8% per year[22]. Second, both studies show that the net job creation rate is lower for larger firm size classes.

Table 4 gives a more in depth overview of the differences between the industries. The overall net job creation rates vary considerably, ranging from -2,7% for Mining and Quarrying to +5,9% for Real Estate, Renting and Business Activities. The pattern across size classes shows much less variation: for six of the eight included industries, the net job creation rates monotonically decline with firm size class. The two largest industries, however, show a different pattern. In the Trade industry (24% of the total employment), the net job creation rates *increase* monotonically with firm size class. In Manufacturing (27% of total employment), the smallest and largest size class show the same net job creation rate. For this industry, the net job creation rates vary the least between firm size classes.

Table 4 Average net job creation rates in the non-financial business economy of the EU, by industry and size class, based on dynamic classification (2002-2008)

	Size class (occupied persons)				
Industry (NACE rev. 1.1 section)	*0 to 10*	*10 to 50*	*50 to 250*	*250 +*	*Total*
Mining and quarrying (C)	0.0%	-0.7%	-1.0%	-3.5%	-2.7%
Manufacturing (D)	-1.0%	-0.6%	-0.6%	-1.0%	-0.8%
Electricity, gas and water supply (E)	6.3%	0.9%	-0.3%	-1.0%	-0.7%
Construction (F)	3.5%	1.8%	1.8%	1.4%	2.5%
Wholesale and retail trade (G)	1.3%	1.8%	2.3%	2.8%	1.9%
Hotels and restaurants (H)	4.6%	3.6%	3.3%	1.8%	3.7%
Transport, storage and communication (I)	3.4%	3.2%	3.1%	-0.5%	1.1%
Real estate, renting and business activities (K)	8.6%	4.1%	4.3%	5.2%	5.9%
Total (C-I, K)	3.1%	1.6%	1.3%	1.0%	1.8%

The non-financial business economy of the EU includes sections C –I and K of the NACE rev. 1.1 classification of economic activities. The wholesale and retail trade (G) includes repair of motor vehicles, motorcycles and personal and household goods.

Source: Own calculations, based on the database for the Annual Report 2009 (for the years 2002-2004) and the database for the Annual Report 2010/2011 (for the years 2005-2008).

It has already been suggested that the relationship between net job creation rates and firm size may differ between industries (e.g. Audretsch et al, 2004, and Neumark et al., 2011). Our results confirm that this is indeed the case. Much of the existing literature on this topic focuses on manufacturing and we discuss the results for this industry in a somewhat more detailed manner.

First, we observe that Neumark et al. (2011, p. 24) also found somewhat different results for manufacturing. For all industries together they found that net job creation rates decrease monotonically with size class. However, they did not find this relationship with regards to manufacturing and only found a negative rank-order correlation between net job creation and size-class.

[22] Neumark et al. (2011) did not present an average net job creation rate across all size classes. We have therefore computed the ratio between the average net job creation for all size classes and the average employment across all size classes, based on the statistics presented in panel II of Table 1.

The question then is why manufacturing exhibits a different pattern. This is not an easy question to answer. With respect to other industries, the manufacturing industry can be characterized as an industry with relatively high entry barriers, a relatively high capital intensity and a relatively high economy of scale (up to a certain firm size). Audretsch et al. (2004, pp. 305-307) demonstrated that be-cause of these characteristics one would expect that net job creation rates would show a sharper decline with size class in manufacturing compared to the other industries. However, we observe in this paper (and Neumark et al. to a lesser extent as well) the exact opposite! Unfortunately, our data set does not permit a further analysis of this subject.

Finally, Table 5 addresses differences between the EU Member States. With the exception of Malta, all Member States show an increase in employment levels in the non-financial business economy between 2002 and 2008, with the highest net job creation rates reported for Bulgaria (4,1%) and Lithuania (4,6%).

This table also shows a negative relationship between net job creation rate and firm size class. Although only 7 of the 27 countries exhibit a net job creation rate that decreases monotonically with firm size class, the large majority of countries (24 out of 27) exhibit a negative rank-order correlation between net job creation rate of a firm size class and the ranking of that firm size class[23]. In addition, for the large majority of countries the net job creation rates are higher for the SME size class (0 to 250 occupied persons) than for the size class of large firms and for most countries the net job creation rates for the smallest size class are higher than for the largest size class[24].

[23] For each country, we have calculated the Pearson rank-order correlation between the (rank of the) net job creation rates for the four different size classes and the ranking of the size classes (where the ranking increases with average firm size).

[24] Only the Czech Republic and Poland do not meet either one of these conditions.

Table 5 Average net job creation rate in the non-financial business economy of the EU, by country and size class, based on dynamic classification (2002-2008)

	Size class (occupied persons)				
Country	*0 to 10*	*10 to 50*	*50 to 250*	*250 +*	*Total*
Austria	2.8%	1.5%	1.8%	1.9%	2.0%
Belgium	2.2%	0.7%	0.9%	1.4%	1.4%
Bulgaria	5.4%	7.8%	3.9%	0.6%	4.1%
Cyprus	3.7%	4.4%	4.6%	3.3%	3.9%
Czech Republic	-1.5%	1.2%	2.0%	0.3%	0.2%
Denmark	3.0%	1.5%	1.2%	0.8%	1.5%
Estonia	7.3%	2.8%	3.1%	0.8%	3.5%
Finland	3.0%	1.5%	1.4%	0.5%	1.4%
France	3.0%	0.3%	0.1%	1.1%	1.2%
Germany	2.9%	1.6%	2.1%	0.7%	1.6%
Greece	2.1%	4.0%	1.0%	-0.5%	1.7%
Hungary	0.5%	1.2%	0.0%	-0.1%	0.3%
Ireland	7.9%	3.9%	2.5%	0.9%	3.4%
Italy	2.0%	1.3%	1.3%	1.1%	1.6%
Latvia	5.1%	3.8%	2.0%	0.6%	2.8%
Lithuania	11.3%	4.1%	2.8%	1.1%	4.6%
Luxembourg	3.6%	2.5%	2.3%	-0.7%	1.5%
Malta	-3.0%	1.5%	1.2%	-3.8%	-1.6%
Netherlands	7.6%	0.9%	-2.9%	0.7%	1.4%
Poland	1.9%	3.3%	3.4%	3.0%	2.7%
Portugal	4.1%	1.6%	1.3%	1.8%	2.6%
Romania	15.6%	5.3%	0.4%	-3.3%	2.5%
Slovakia	23.1%	1.7%	1.9%	-0.1%	3.6%
Slovenia	2.8%	1.0%	-0.8%	1.4%	1.3%
Spain	3.6%	1.7%	2.5%	3.5%	2.9%
Sweden	0.8%	4.0%	3.7%	1.5%	2.0%
United Kingdom	3.7%	0.5%	0.3%	0.8%	1.3%
Total	3.1%	1.6%	1.3%	1.0%	1.8%

Source: Own calculations, based on the database for the Annual Report 2009 (for the years 2002-2004) and the database for the Annual Report 2010/2011 (for the years 2005-2008).

6. Conclusion

Since the analysis conducted by Davis et al. (1996), it is well known that there is no straightforward way to determine the contribution of small businesses to job creation. So far, many rivaling methods have been proposed in the literature to determine this contribution, without consensus as to which method should be the preferred method. In this paper we argue why the so-called dynamic classification method should be favored in our opinion. First, it is the only method that consistently attributes job creation or loss to the size class in which it actually occurs. This seems to be a compelling and reasonable principle to us. In addition, dynamic classification has two further advantages: (i) it is not vulnerable to the so-called regression to the mean bias and (ii) only a small number of aggregated data are required for it's application. This last point has so far been overlooked in the literature.

Using dynamic classification we analyze the job creation of different size classes for the 27 Member States of the European Union. Our major findings can be summarized as follows:

- For the EU as a whole, smaller firms contribute more to job creation than larger firms. Net job creation rates decrease with each firm size class.
- This pattern occurs in most industries but not in all: the manufacturing industry and trade industry – comprising approximately half of the employment of all considered industries - show different patterns.
- At the level of individual countries, the net job creation rate also tends to decrease with each firm size class. However, this relation is not perfect. The net job creation rate only decreases monotonically with each firm size class in 7 Member States. However, the large majority of countries exhibit a negative rank-order correlation between the net job creation rate of a size class and the ranking of that size class.

What are the implications of the findings in this paper? First, we believe that the rarely used method of dynamic classification should be used more often in any thorough study conducted on job creation of small businesses. We believe that Butani et al. (2006) did a good job in advocating this method. However, as the recent analysis of Neumark et al. (2011) shows, their arguments have generally not been adopted until now. This paper elaborates on some of their arguments in further detail and therefore, can contribute to a wider acceptance of dynamic classification.

Second, only a small number of aggregated data are required for dynamic classification, viz. the employment level and the number of firms in each size class within each time period. This is of importance, meaning that researchers do not need to have access to longitudinal firm level data to make the calculations, as is the case with rivaling methods. These aggregated numbers should be easy for statistical agencies to provide, as they don't involve difficult calculations or serious disclosure risks. In addition, the analysis also becomes possible for countries for which no longitudinal firm level data are available, such as many developing countries.

This paper therefore paves the way to undertake analyses on the job creation of small businesses on a much larger scale than was previously possible. In a way, this paper itself is an example of this. Due to data limitations the analysis in this paper for the whole European Union would not have been possible without the method of dynamic classification.

Third, this paper finds that, for the European Union as a whole, small businesses create more jobs. This finding of Birch back in the eighties of the former century, was already recently confirmed by Neumark et al. (2011) for the USA. Now it has also been confirmed for the European Union as a whole.

This confirmation is not trivial, because obviously the observed regularity that small businesses create more jobs can be at most, a tendency rather than a strict law that always holds true. This is nicely illustrated by our finding that for (sometimes large) subsets of the European Union small businesses do *not* create more jobs. Therefore, if you want to be certain about the job creation of small firms in a specific country for a specific industry and for a specific time period, extra analyses will remain necessary. Fortunately, dynamic classification (see our second point above) makes it relatively easy to undertake these extra analyses.

In conclusion, we address some research limitations. First, this paper sets out to classify net job creation into size classes in the best way possible. Therefore, job growth of firms is *only* related to the size of firms. In addition, there are many other factors that influence firm growth, such as firm age or the motivation or the ability of the entrepreneur owning the firm. However, the investigation of such other factors is beyond the scope of this paper.

Second, and in relation to the first point, this paper only gives insight in *how* different size classes perform with respect to net job creation, not *why*. Answering the latter question would involve other data and another research setup. Therefore, this type of research not only answers questions, but also raises new ones. In this paper, for example, manufacturing appears to have an unexpected size class pattern with respect to net job creation. The explanation for this will have to be left to future research.

Third, following the existing research, we distinguished size classes in this paper. Theoretically, the introduction of size class boundaries could produce biases. [25] Although we cannot rule out this possibility, we do not think this is a major problem as in Neumark et al. (2011, pp. 26-27), such potential biases did not appear to be dominant.

[25] For example, in this paper micro businesses are defined as businesses with 0- 10 employees. They create on average over a million jobs a year in the European Union (see table 3). Theoretically (although we have no reason to believe this is probable), it could be possible that most of these jobs are created by firms with size 8-10 employees. If this would be the case, defining micro businesses as businesses with 0-8 employees would generate quite different results.

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